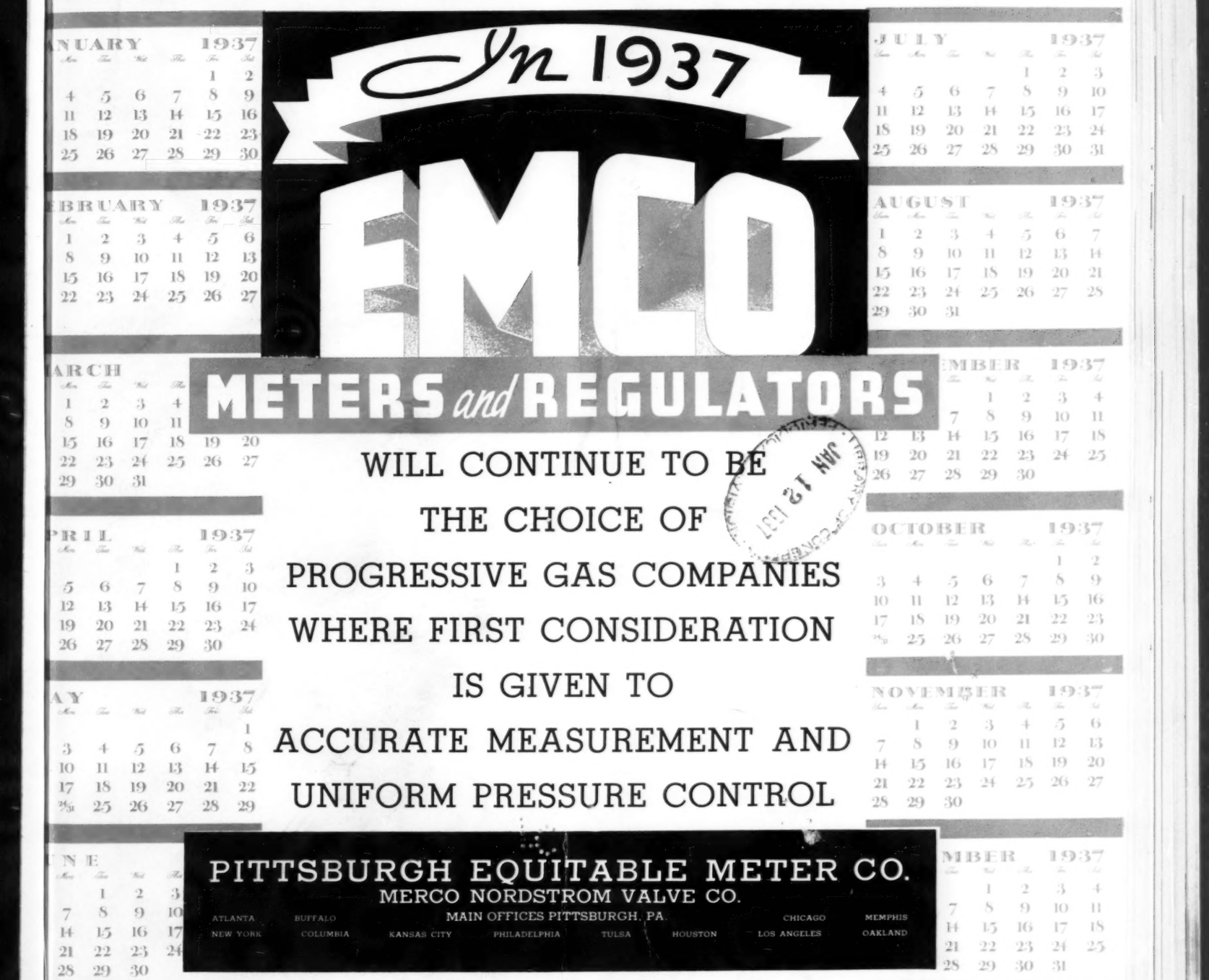
GAS

FORMERLY WESTERN GAS

ENGINEERING • UTILIZATION • LOAD-BUILDING • MANAGEMENT



PITTSBURGH EQUITABLE METER CO.

MERCO NORDSTROM VALVE CO.

MAIN OFFICES PITTSBURGH, PA.

ATLANTA · BUFFALO · CHICAGO · MEMPHIS · NEW YORK · COLUMBIA · KANSAS CITY · PHILADELPHIA · TULSA · HOUSTON · LOS ANGELES · OAKLAND

TP700
.P3

TODAY

as 100 years ago

they're laying long-lived cast iron pipe but with modern bottle-tight mechanical joints.

TODAY—A recent installation of mechanical joint cast iron pipe for gas service in the City of Philadelphia.

A CENTURY AGO—A cast iron gas main in service in the City of Philadelphia for more than a century.

Where can you find another engineering material that has met the changing conditions of a century of gas service? Cast iron pipe is the same long-lived, economical material but with the addition of mechanical joints that are bottle-tight under modern working pressures. Proved so by performance and the A.G.A. laboratory. Made by CIPRA members for cast iron pipe in diameters from 1¼ to 84 inches.

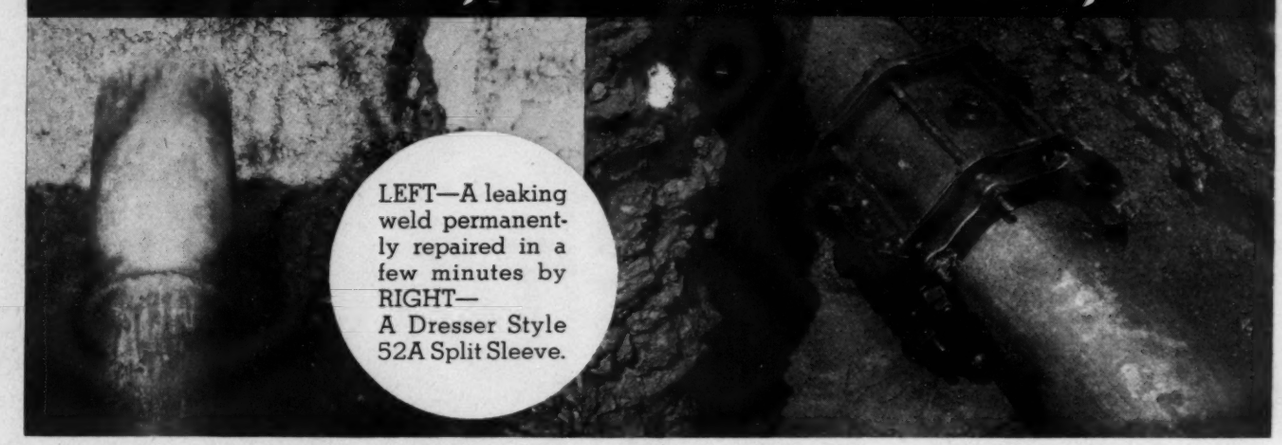
CAST IRON PIPE

THE STANDARD MATERIAL FOR UNDERGROUND MAINS

The Cast Iron Pipe Research Ass'n, Thos. F. Wolfe — Research Engr., 1013 Peoples Gas Bldg., Chicago

A DRESSER SPLIT SLEEVE *Repairs* Almost Any Pipe-Break

. . *Quickly! Permanently!*



LEFT—A leaking weld permanently repaired in a few minutes by RIGHT—
A Dresser Style 52A Split Sleeve.

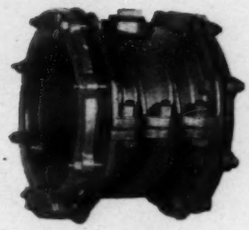
Ordinary labor installs a Dresser Repair Sleeve over a break in just a few minutes, without service interruption, and oftentimes without even reducing the pressure—and you'll never have to go back and do the job over again. The Dresser end and side packs give an *instant*, lasting seal, and provide flexibility to prevent a repetition of the break.

There's a Dresser Split Repair Sleeve for every type of break or leak in steel pipe or steel-pipe joints. One or two of these rubber-packed Sleeves in stock may save you hundreds of dollars in emergency repairs.

When ordering, specify style number, outside diameter of pipe, working pressure, and type of pipe-break or pipe joint to be repaired. *Rush orders are given special attention.*

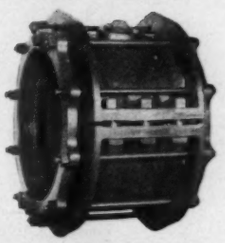
S. R. Dresser Manufacturing Co., Bradford, Pa.

In Canada: Dresser Mfg. Company, Ltd., 60 Front St., W., Toronto, Ont.



STYLE 52A

Completely encloses and permanently repairs *plain circumferential welds, screw collars, welded bell-and-spigot joints,* and *double-bell welded joints.* Covers pipe-splits or holes up to 8" in length. For working pressures up to 500 lbs. per sq. in. For all steel-pipe sizes from 4" I.D. to 26" O.D., inclusive. Write for further information.



STYLE 73

A light, inexpensive Split Sleeve. Encloses and permanently repairs *circumferential welded joints* and *screw collars,* as well as splits or holes in the pipe up to 8" in length. Two or more can be joined together in multiple installations for longer breaks. For working pressures up to 250 lbs. per sq. in. For all steel-pipe sizes from 2" I.D. to 12" I.D. inclusive. Further information on request.

STYLE 54A

Style 54A has sufficient inside clearance to enclose completely, and repair permanently, leaking joints of the *bolted type.* Recommended for working pressures up to 500 lbs. per sq. in. Available in all standard steel-pipe sizes from 2" I.D. to 26" O.D. inclusive. Write for further information.

CAST IRON PIPE: *Styles 57 and 26 Split Repair Sleeves are available for enclosing and permanently repairing breaks in the straight run of cast-iron pipes, and broken or split bells.*

KEEP A DRESSER SLEEVE ON HAND FOR QUICK REPAIRS

ADVERTISERS' INDEX

The American Brass Co.	31
American Liquid Gas Corp.	48
American Meter Co.	10
American Stove Co.	39
The Barber Gas Burner Co.	42
Barton Brown Engineering Corp.	48
The Barrett Co.	3
H. R. Basford Co.	62
Blaw-Knox Co.	61
The Bristol Co.	8
The Cast Iron Pipe Research Ass'n.	2nd Cover
The Chaplin-Fulton Manufacturing Co.	38
Clark Hotel	44
Colonial Shops	44
Connelly Iron Sponge & Governor Co.	58
The Cooper-Bessemer Corp.	45
Crane Co.	7
Cribben & Sexton Co.	—
Dearborn Chemical Co.	62
Detroit Michigan Stove Co.	—
Domestic Manufacturing Co.	59
S. R. Dresser Manufacturing Co.	1
Electrogas Furnace & Mfg. Co.	60
Electrolux Refrigerator Sales, Inc.	—
Ensign Carburetor Co.	40
Fluor Corporation, Ltd.	63
Forster Manufacturing Co., Ltd.	—
Fraser Furnace Co.	62
James Graham Manufacturing Co.	35
Greenlee Tool Co.	61
Grove Regulator Co.	—
Handbook, Butane-Propane Gases 2nd Edition	46-49
Inland Manufacturing Co.	—
Johns-Manville	—
Johnson Gas Appliance Co.	64
Kerotest Manufacturing Co.	48
Merco-Nordstrom Valve Co.	Front Cover
Milwaukee Gas Specialty Co.	64
Minneapolis—Honeywell Regulator Co.	—
L. J. Mueller Furnace Co.	43
The National Supply Co.	5
National Tube Co.	—
Natural Gas Equipment, Inc.	63
Norge Division, Borg-Warner Corp.	29
Pacific Coast Gas Association, Inc.	54
Pacific Gas and Electric Co.	57
Pacific Gas Radiator Co.	56
Parkhill-Wade, Inc.	59
Payne Furnace & Supply Co.	41
Pittsburgh Equitable Meter Co.	Front Cover
Porcelain Enamel Institute	33
Pressed Steel Tank Co.	49
Reliance Regulator Corp.	50
Republic Steel Corp.	4
Reynolds Gas Regulator Co.	53
Robertshaw Thermostat Co.	27
Safety Gas Main Stopper Co.	46
M. B. Skinner Co.	6
Spencer Thermostat Co.	—
The Sprague Meter Co.	Fourth Cover
United States Pipe & Foundry Co.	Third Cover
United States Steel Corp.	—
Ward Heater Co., Ltd.	42
Welsbach Co.	37
Worthington Pump & Machinery Corp.	—

GAS

FORMERLY WESTERN GAS

LOS ANGELES Office: 810 South Spring Street. Phone Michigan 1481
CHICAGO Office: 1064 Peoples Gas Building. Phone Harrison 8536

JAY JENKINS, Publisher **GEORGE H. FINLEY, Editor** **CRAIG ESPY, Mid-Western Manager**
ARTHUR ROHMAN, Managing Editor **ANATOL FOMILYANT, News Editor**
W. G. RUSSELL, Field Representative

Contents for January, 1937

GUEST EDITORIAL: The Human Factor—Industry's Problem . . . 9
By Clifford Johnstone

Detroit Writes Finis to Natural Gas Project . *By F. P. Fisher* 11

Selecting a Natural Gas Engine . . . . . *By C. Remschel* 13

G A S Camera 15

The Sales Value of Commercial and Industrial Gas Advertising . . 16
By J. P. Leinroth

Relief Valves—Their Installation and Maintenance *By F. A. Hough* 18

ABSTRACTS BY THE STAFF

Success of National Advertising Lies with Cooperating Companies . 22

Solutions to Some Problems Arising from Winter Gas Troubles . 24
By A. H. Abbott and R. L. Rundorff

Commercial Cooking Appliances Offer Profitable Field for Gas . 25
By W. Frank Roberts

Welding in Constructing, Operating, Maintaining Pipe Lines . . 26
By T. R. Jones and R. P. Gonzales

BUTANE-PROPANE NEWS 47

Bottled Gas As An Ally To Piped Gas Service 47
By H. Emerson Thomas

MEASUREMENT AND CONTROL 51

Slide Rule—Its Use to Determine Combined Correction and Super-expansibility Factors in Gas Measurement 51
By W. E. Helmick

Jonuary, 1937. Volume XIII, Number 1. G A S is published monthly by Western Business Papers, Inc. at 810 South Spring Street, Los Angeles, California. Subscription price (in advance), 25 cents the copy. $2.00 per year; 2 years, $3.00; $3.00 per year foreign. Entered as second class matter August 20, 1936, at the post office at Los Angeles, Calif., under the Act of March 3, 1879. Copyright, 1937.

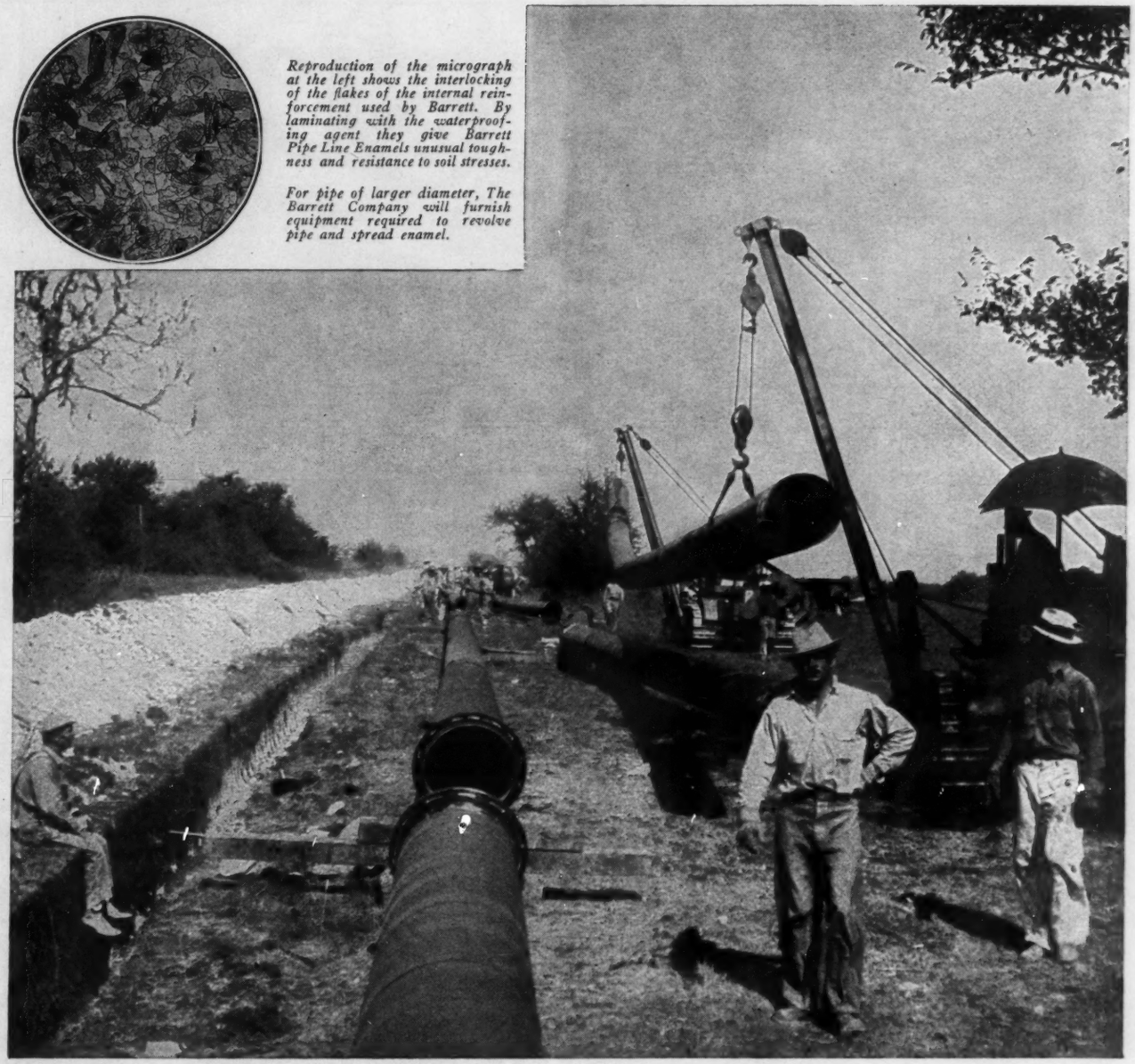
MEMBER AUDIT BUREAU OF CIRCULATIONS

OFFICIAL PUBLICATION: Pacific Coast Gas Association; Southern California Meter Association.

MEMBER: Audit Bureau of Circulations; Associated Business Papers, Inc.

Reproduction of the micrograph at the left shows the interlocking of the flakes of the internal reinforcement used by Barrett. By laminating with the waterproofing agent they give Barrett Pipe Line Enamels unusual toughness and resistance to soil stresses.

For pipe of larger diameter, The Barrett Company will furnish equipment required to revolve pipe and spread enamel.



Courtesy, Lone Star Gas Co.

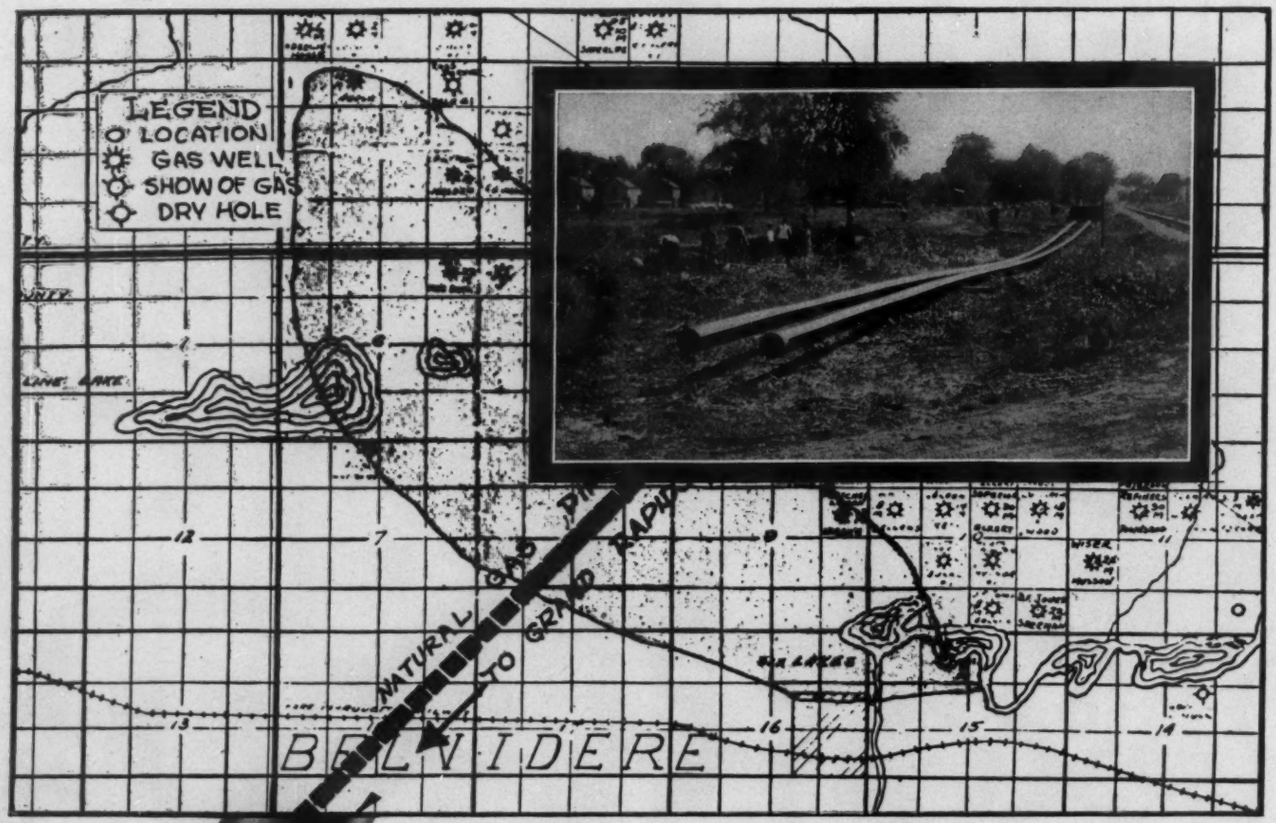
A pipe line worth laying is worth protecting against corrosion . . .

You can defer reconditioning for many years with a waterproof, dielectric coating of enamel which keeps soil acids, moisture and electric currents away from the metal. The unique laminated structure of Barrett Pipe Line Enamels gives them greater resistance to soil stresses, makes them tougher and more flexible—promotes complete and lasting protection against corrosion. For detailed information, phone, write or wire.

The Barrett Company, 40 Rector St., New York, N.Y.

FIELD SERVICE: Carefully trained Barrett field men will gladly work with you, combining their special knowledge and experience with your familiarity with conditions along the right of way.

Barrett
PIPE LINE ENAMELS



Republic LINE PIPE BRINGS NATURAL GAS TO GRAND RAPIDS

Over hill and through valley — across swamps (eighteen of them) — over quicksands — across rivers goes Republic Electric Weld Line Pipe — 37 miles of 10¾ in. O. D. — to bring natural gas from the Hinton-Belvidere-Milbrook county field to Grand Rapids, Michigan. The entire line is welded — constructed for 450 lbs. pressure. Innumerable over-bends and side-bends were made cold in the field with the use of tractors, winches and trucks.

Again this modern, mechanically-perfect, electric resistance welded pipe leaves its indelible mark on the gas map of the nation. And with the construction engineers and superintendents — with the gas company officials — it leaves remembrance of its perfect roundness, uniform wall thickness, 100% weld, high yield with high ductility, weldability and lengths up to 50 feet without mid-weld. Let us tell you why you, too, should use it.

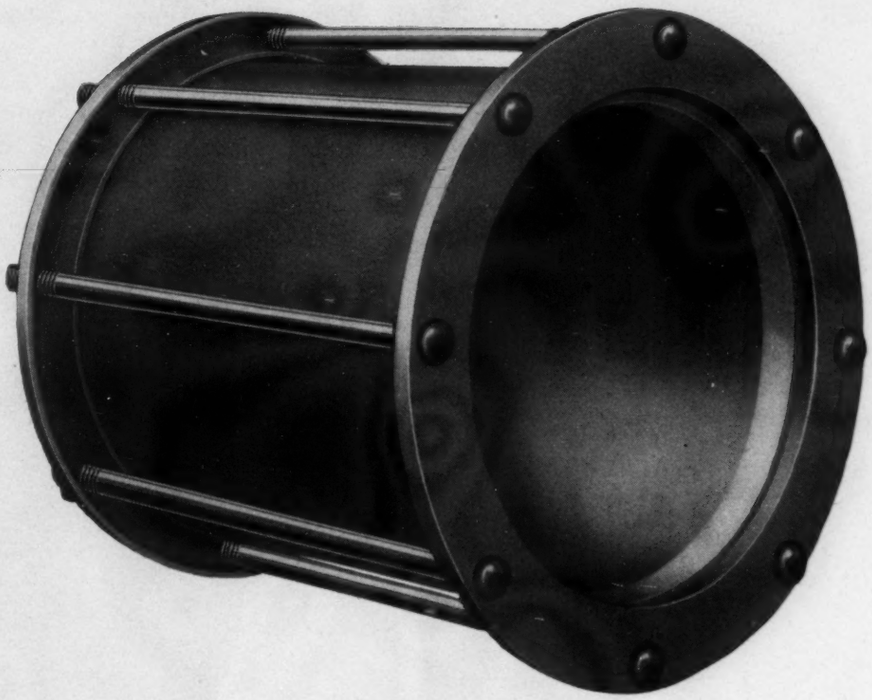
Republic Steel Corporation

GENERAL OFFICES . . . CLEVELAND, OHIO

REPUBLIC STEEL

DAYTON NO. 5

LONG SLEEVES



An efficient, economical means for easily and rapidly repairing broken lines. Also used extensively as an expansion joint in the original installation of welded lines. Sizes up to 24" O. D.

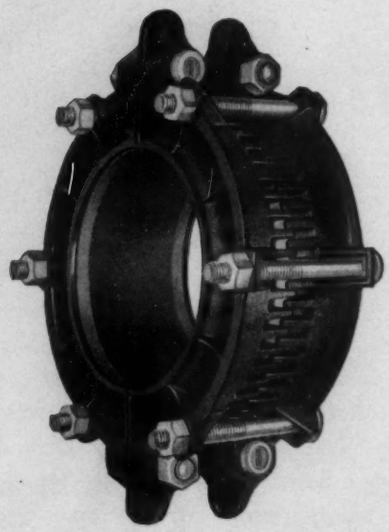
THE NATIONAL SUPPLY CO. OF DELAWARE
DAYTON COUPLING DIVISION · · DAYTON · OHIO

QUICK, PERMANENT REPAIR FOR BROKEN MAINS

SKINNER SPLIT COUPLING CLAMPS can be installed easily and without shutdown by **ONE MAN** in from 12 to 20 minutes—a great time saving when compared with old-fashioned cast iron split sleeves, which usually take two or three men 3 or 4 hours to apply.

And these Clamps are permanent—for pressures up to 600 lbs., with ample excess strength guaranteed. Clamp is of malleable iron, heavily enamelled; sturdy steel bolts are cadmium plated; soft gum and carbon black gasket is **SEALED** by Monel metal seal band, under tremendous pressure. Stops the original leak. Provides a degree of flexibility which prevents future breaks at the same point. Thousands used yearly on both gas and water mains.

Get ready now for the trouble that's sure to come when sub-zero weather arrives. Order Skinner Split Coupling Clamps for each size of main—then see for yourself the savings in time and money.



GET COMPLETE CATALOG

M. B. SKINNER CO. *Est. 1898* **SOUTH BEND, IND.**

"Looking into Tomorrow"

Crane research engineers are always testing ahead of industry's actual needs. It is the only way they can be sure of having valve materials and designs ready for the pressures, temperatures and corrosive elements expected tomorrow.

If you have a tough valve, fitting or piping problem, come to Crane. With the most extensive research laboratories in the business—the largest plant—the biggest line—Crane can supply what you want, if anybody can!

Most "new" valve problems can easily be solved by reference to your No. 52 and other Crane Catalogs. In them are the answers to a host of questions that Crane has answered successfully for thousands of users. In them are the details regarding over 38,000 items, tested in the laboratory and proved on the job. Use them whenever you need valves, fittings, pipe or accessories.

CranEquip for satisfaction.

CRANE

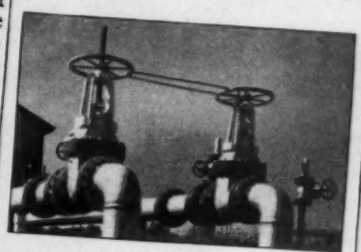
CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVENUE, CHICAGO ILL.

Branches and Sales Offices in One Hundred and Sixty Cities

VALVES, FITTINGS, FABRICATED PIPE, PUMPS, HEATING AND PLUMBING MATERIAL

plied in the next few days.

FROM CASING HEAD TO KITCHEN BURNER



TULSA, OKLA., Dec. 18—All along the line of natural gas—from the casing head to city limits—Crane valves, fittings and fabricated pipe are wonderful guardians of the natural gas which you must deliver.

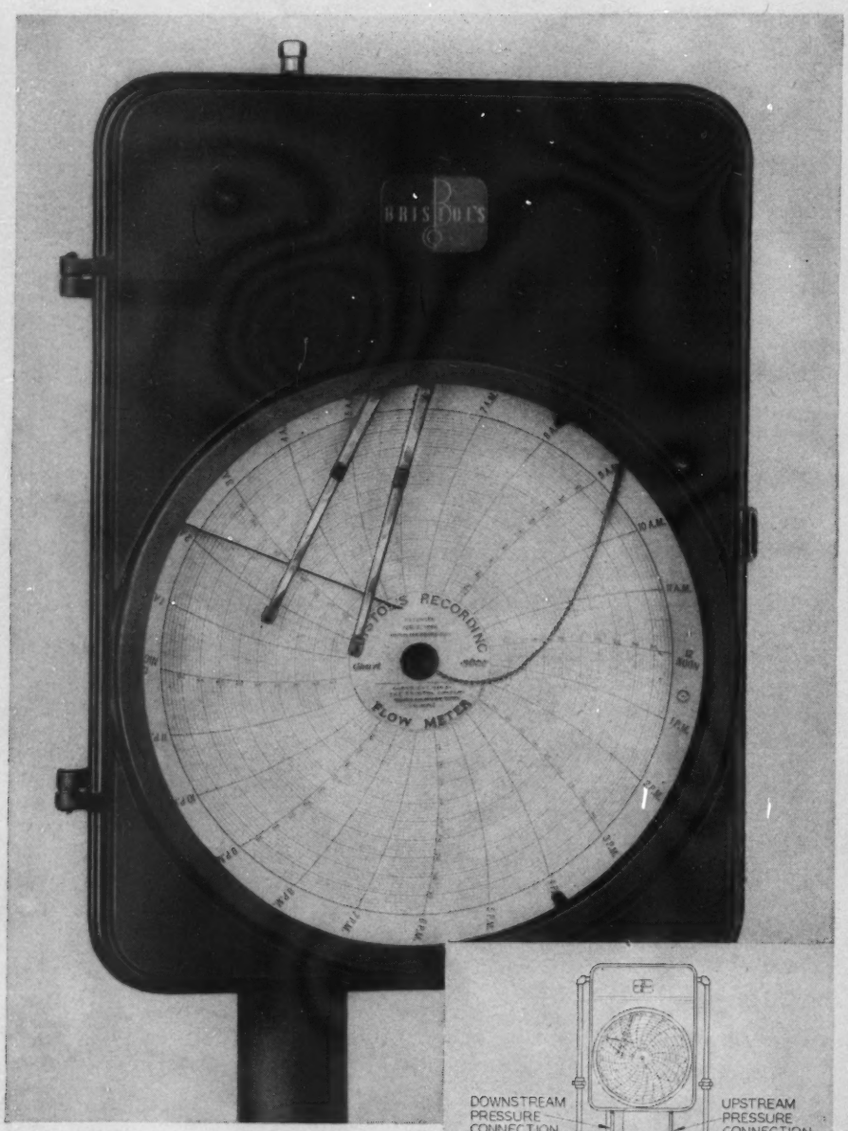
CranEquip the system for which you are responsible for Crane has the equipment which will serve you best. Approximately 600 Crane distributors and branches have stocks of valves, fittings and pipe. That means quick service to your operations almost anywhere in the country. Buying from a single source simplifies your work, unifies responsibility for quality and service.

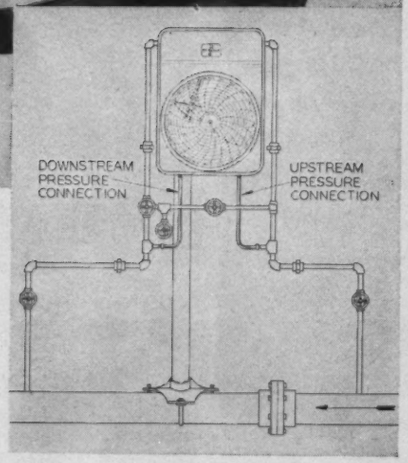
Keep Crane Catalog Handy

Construction, maintenance and emergency problems involving piping are generally quickly solved by referring to your Crane No. 52 Catalog for equipment which will help you. Among the 38,000 items listed there is an answer to practically every pipe-line need. There are also many pages of engineering data which may be of great assistance to you. Learn to know your way around in your Crane catalog.

BRISTOL'S *Flow Meter*

. . . with differential pressure element for recording the mean upstream and downstream static pressure





A diagrammatic sketch of a typical installation.

The instrument automatically averages the two pressures—absolute accuracy . . .

EQUIPPED with two pressure connections,—one leading to the upstream side of the orifice and a second to the downstream side, Bristol's new Flow Meter averages both pressures with mathematical precision. The mean of the two pressures is recorded on the chart.

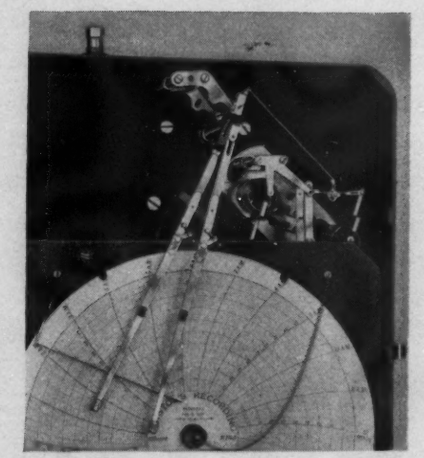
This is done automatically.

Write for Bulletin 475-N.

Left: Bristol's Flow Meter, Model 1140M, for metering large consumptions in industrial applications. Equipped with new Pressure Averaging System.

THE BRISTOL COMPANY
WATERBURY CONNECTICUT
Branch Offices: Akron, Birmingham, Boston, Chicago, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, Seattle. Canada: The Bristol Company of Canada, Limited, Toronto, Ontario. England: Bristol's Instrument Company, Limited, London, N.W. 10

BRISTOL'S
TRADE MARK REG. U.S. PAT. OFF.



A close-up of the Pressure Averaging System.

GAS
January, 1937

Guest Editorial

THE HUMAN FACTOR – INDUSTRY'S PROBLEM

By CLIFFORD JOHNSTONE
Managing Director, Pacific Coast Gas Association

THERE is a platitude frequently expressed by members of the gas industry to the effect that the industry was for long years enshackled by the weight of its technical problems and that now, when there is no further important use for engineering, we have at last become sales-minded and can devote all of our time and energy to that paramount phase of our business.

Without in any way minimizing the importance of sales effort, it is entirely possible that this thought is wrong both in premise and conclusion.

That the industry has always been awake to its marketing problem is indicated by the most cursory examination of past Association records. Dealer cooperation was being discussed back in 1880, and one of the most intelligent analyses of the problem ever made was presented to the American Gas Light Association in 1896. The first paper read to the first convention of the Pacific Coast Gas Association in 1893 discussed the competition offered to gas sales by electricity. The men of those days may have been handicapped by their technical inability to provide a fuel which could capture certain markets, but they were fully as alive to their sales problems as we are today. They laid the foundation upon which we are still building.

Furthermore, engineering is still at least equal to sales in its importance and service to the industry. Our sales departments must have something they can sell and it is the responsibility of our engineers to provide it. There will be no sale unless when the valve is turned the customer is assured of an adequate supply of clean gas delivered to him at a price commensurate with its value to him and used through an appliance which equals or betters the service of any competitive appliance. All of these things are the responsibility of our engineers. At nearly all general conventions of the industry the technical meetings are the best attended, the most prolific, and the most earnest.

So far for the premise. The industry has always had both engineers and salesmen, and it needs them equally today. In fact, there is no line of demarcation between them because their problems interlock at every point. Each of us must be a salesman and each of us must keep abreast of the technical improvements in the industry.

Now for the conclusion that sales are our paramount problem. Important though this problem is, there is one still more vital. This editorial is written on the day following a great mass meeting in San Francisco's Civic Auditorium in which leaders of employers and employees discussed the issues in the current shipping strike. This meeting was heralded by the press as being an unprecedented and history-making affair, but more than anything else the speakers revealed a terrifying difference in fundamental thought on the part of the two groups involved. There were outcroppings of hatred and distrust, and almost nowhere any evidence of a meeting of the minds in an honest effort to solve the issues involved. Multiplying this one example by the hundreds of similar situations existing in almost every industry we must realize that in the operation of our boasted democracy we have somehow failed to eliminate classes and the warfare between classes. Raising our eyes we see other parts of the world in which democracy has failed to stem the clash of classes and we wonder if, after all, it cannot happen here.

It is not finance nor production nor sales, but it is the human problem which is the paramount problem of the gas industry and all industry. In no other phase of our life does the ideal so differ from the practical, nor the mind so control the heart. In no other problem is reason of so little avail and emotion such an important tool. Blame whom you will, industry in general and public utilities in particular have not achieved a harmonious relation with either their own employees or the general public.

What we, both employers and employees, are going to do about it is the first problem of the gas industry. Only one thing is sure. It cannot be solved by engineering graphs or actuarial tables or printed rules. Human problems require something more. Two great forces motivate human relations. The first is self-interest, the selfishness which drives men to work for the things they want and is responsible for the material progress of the race. It is also responsible for wars between nations and classes and for a large share of all human misery. The second force is the spiritual quality in man as expressed in religion and in the unselfishness and consideration of one man toward another. In the dictionary selfishness and unselfishness are antonyms, but in life they are inextricably mixed. Selfishness is the active quality which promotes action; unselfishness is the flux which tempers this action to make it bearable. This conflict must be recognized and accounted for in any sincere effort to improve human relations, whether it be between individuals, nations, employer and employee, or between a corporation and its customers.

Why

Low Maintenance

out in the field

Specifically...

● We might point out the rugged construction of Westcott orifice meters . . . the differential body of forged steel—with screw and welded connections between chambers, and stainless steel parts within the mercury chamber. . . . A hardened stainless steel stuffing box. . . .The pressure spring of special alloy or stainless steel, connected without soldering. . . . Only one moving part between mercury surface and chart record. . . . Spring driven, electric or gas motor driven clocks. . . . Scientifically selected materials. . . . Simplicity. . . . Easy adjustment. . . . Easy cleaning.

● The Westcott is a **PRACTICAL** engineering instrument, devised to hold its own in the producing field, in the refinery, and in other process plants where there is neither time nor inclination to pamper meters.

● Complete facts in our literature on Westcott Indicating, Recording or Integrating Orifice Meters and Flowmeters—including the popular new Round Case Indicating Flowmeter.

347

AMERICAN METER CO. MEASUREMENT ENGINEERS

AMERICAN METER COMPANY
INCORPORATED
Measurement and control of Gas, Oil, Steam, Air and Liquids
PACIFIC METER WORKS • LOS ANGELES • SAN FRANCISCO

January, 1937

GAS

Vol. XIII, No. 1

THIRTEENTH YEAR OF PUBLICATION

LOS ANGELES—810 South Spring Street . . 1064 Peoples Gas Building—CHICAGO

DETROIT WRITES FINIS TO NATURAL GAS PROJECT

Just a year ago in the pages of GAS Mr. Fisher outlined the ramifications of the "Detroit Plan" which introduced to the gas consumers of the Michigan city a "profit-sharing" rate structure. In the development of this plan and in reconciling the city and company viewpoints, Mr. Fisher played a prominent role. The complete story of the bringing of natural gas to Detroit was related in the September "Detroit Souvenir" issue of GAS. With this article Mr. Fisher summarizes the fulfillment of this huge change-over project.—EDITOR.

By F. P. FISHER

Consulting Engineer

A YEAR ago, it was my privilege through these pages to discuss "The Detroit Plan", an ambitious scheme, which involved:

1. The bringing of a supply of natural gas from fields in and near the Texas Panhandle to Detroit, 1200 miles away.

2. The change from manufactured gas service to straight natural gas service in the largest metropolitan community thus far served with straight natural gas.

3. The sale of this gas to consumers through a unique arrangement for profit-sharing, involving a "consumers' dividend", based on the earnings of the company and payable at the end of each year to domestic consumers in proportion to their use of the service.

It is now my privilege to chronicle the fulfillment of these hopes by bulletining the facts that the new service of straight natural gas reached the last and all of Detroit consumers in their readjusted appliances on November 7, and that the new service is now fully inaugurated. The next milestone will come at the close of the first year's experience in selling this gas to the million and one-half people in the Detroit metropolitan area.

Because of the great distance and the large pipe line investment involved, it was necessary to develop a carefully balanced "load factor" form of rate for delivery of gas at the "city gate". This rate consists of a demand and a commodity charge. It furnishes a natural incentive to the distributing company, encouraging the development, as nearly as possible, of a continuous full load for the pipe line, thus making a minimum burden of cost on each unit of gas transported. By means of this form of rate, it became possible to sell this gas in Detroit for industrial and house-heating service at prices competitive with other fuels, thus providing for a full development of the rich potential fuel market of this area. The consumers' dividend feature of the plan, we are confident, provides automatically a form of rate regulation that will be immediately responsive to every increase of earnings and such increases will be automatically followed with the corresponding rate reduction in the form of a dividend with the closing of the books at the close of each fiscal year.

It is important to recognize the fundamental basis and purpose of this dividend; so, at the risk of some slight repetition, I will reiterate, that gas sold for industrial and house-heating purposes needs no price regulation. If it is offered at a price that is to the consumers' advantage, it will be salable. If the price is higher, less or none will be sold. Other fuels are available for these purposes and the consumers' use of the fuel evidences that it has a competitive value to him.

On the other hand, the furnishing of gas for cooking and water heating is virtually a monopolistic privilege of the company that has the distribution piping in the streets. The consumer, in the absence of some regulation, could be exploited in the price of this service by the utility rates. It is in these rates that the consumer needs the protection of public authority in some form. Under the Detroit Plan, all of the excess earnings from all phases of the gas business go in large measure, in the form of a dividend pro rata, to consumers using the gas for cooking and water heating. There is also participation by the stockholders in these excess earnings sufficient to furnish a motive for the utility to promote its business, both in volume and efficiency to the utmost, all of which accrues, in large measure, to the benefit of these consumers, and to a lesser degree to the stockholder.

The Forecasted Program

When the contract was signed in the fall of 1935 for gas delivery to Detroit, it was proposed that gas would arrive about the beginning of July. The engineering staff of the Detroit City Gas Co. made an intensive study of the problems in changing to natural gas. A committee visited all of the larger cities that had had the recent experience in changing from manufactured to natural or mixed gas. They made most careful study of the methods used and the difficulties encountered. The report of this

survey made a valuable handbook. From all of the experience so analyzed, a program and schedule were carefully prepared for changing the city over between the completion of the pipe line and the coming winter season. Four months were allowed for this program. It was decided to make the change under contract. A contract was made with the Universal Engineering Co. of Delaware to make the appliance adjustments. Close cooperation was provided for between the contractor's organization and the company's staff. It was decided to adjust the appliances by a two-stage procedure to make the smallest possible inconvenience to consumers during the change.

The laying out of this schedule went into great detail, providing for a school of instruction where adjustors would be trained and from which they graduated equipped with some practical experience in making adjustments and a handbook for guidance, detailing not only the technical problem, but also carefully thought out rules of guidance for all of the various contingencies and vicissitudes of contact with consumers, even including deportment and behavior in homes and business establishments. The exact standardized tool box equipment, scheduled arrangements for having tools sharpened and serviced, and uniforms laundered without unnecessary travel of the workman back and forth through city traffic, delivery of supplies, were all worked out on a detailed schedule in this program.

Handling the Gas Supply

The city was divided into 27 sections. This two-stage procedure of adjustment made it necessary to handle, through each of these sections in sequence in order as numbered, a supply of three different kinds of gas in perfect timing with the progress of the appliance adjustment. At the first change, the normal mixture of water gas and coke oven gas was replaced in the section being changed by a supply of pure coke oven gas at high pressure. This gas, because of its characteristic velocity of flame propagation and the extra pressure, would operate sufficiently well to continue the service after the burner "spuds" had been reduced to the one-half size orifice required for natural gas. With the arrival of the high pressure coke oven gas, the first adjustment was carried over the section under treatment, leaving the burners in condition that would operate without serious disadvantage on straight natural gas. When the section was completely covered by the adjustors, natural gas was turned in and the adjustors went again over every burner in the section and made the final adjustment. The time required for adjustment in one section was from two to three days. This called for a gruelling pace. Each of the 27 sections was equal to a city of fifty to seventy-five thousand population. The synchronization of the appliance adjustment and the handling of the gas supply must be perfect. Industrial furnaces and special equipment like scientific laboratories and dental workshops present unusual problems. The dangers to be avoided were complicated and very real. Any unrecorded gas connection across a section boundary would be an accident hazard. Let it be recorded to the full credit of these two operating organizations, that among all these hazards, there was no miscarriage of the plans of sufficient moment to make news.

The program carried the personnel of the organization into every home and establishment in the community. The chances for personality and temperament clashes were without limit. For four months this complex synchronized program was woven into the daily lives of every family in the metropolitan area.

The adjustors and the three different kinds of gas moved over the city area in an advancing wave, beginning at the "City Gate", delivery point of the pipe line, and finally rounding up near the Riverside plant, which furnished the coke oven gas, in a great circular sweep.

Completed on Schedule

The gas arrived at Detroit on the seventh day of July. The adjustment was completed in the last section on the seventh day of November, just the four months provided for in the schedule. The school of instruction for adjustors had begun months ahead of the gas arrival, training first, foremen and supervisors, and finally adjustors, at the rate of 300 or more a week. In selecting this personnel, some 18,000 applicants were interviewed by the personnel officer, R. W. Cornwell.

At the peak of development, 2600 adjustors were in the field. Special personal recognition is due to A. H. Anderson, superintendent of distribution, Detroit City Gas Co., who formulated the adjustment procedure and who was directly responsible for the appliance adjustment end of the program. The engineering staff, responsible for the routing and distribution of gas supplies under the direct supervision of the company's vice-president and assistant general manager, J. W. Batten, and chief engineer, A. I. Snyder, passed sleepless nights for the most part, for nearly four months, but their vigilance was rewarded in the completion of the change-over without mishap, and at the scheduled time.

Among the problems to be solved, were specialized industrial applications, where not only furnace temperature, but atmosphere, heat distribution and heat application must all be solved for a gas of radically different characteristics. These problems were all worked out without a break in the operation of any of the industries served. Long hours of work were the order of the day, not only for foremen and crews, but for executives and engineers.

Many incidental contingencies were foreseen and provided for—extra telephone service and skilled emergency men to be on call for special complaints. The outstanding characteristic of the entire four months' period from an onlooker's viewpoint was the surprising lack of discomfort and disturbance to consumers. Many consumers were uncertain, when questioned as to whether they were burning the new gas or the old, so little was the normal use interfered with by the changes. *(Continued on Page 28)*

Calendar

January

National Bottled Gas Association—6th Annual Meeting, Waldorf-Astoria Hotel, New York City, N. Y., January 20.

American Society of Heating & Ventilating Engineers—Hotel Statler, St. Louis, Mo., January 25-27.

February

Southern Gas Association—Southwest Regional Gas Sales Conference, Peabody Hotel, Memphis, Tenn., February 10-12.

Eastern Natural Gas Regional Sales Conference—William Penn Hotel, Pittsburgh, Pa., Feb. 4-6.

New England Gas Association—Hotel Statler, Boston, Mass., February 10-12.

Midwest Regional Sales Conference—Palmer House, Chicago, Ill., February 18-20.

March

American Society for Testing Materials—1937 Regional Meeting and Committee Week, Palmer House, Chicago, March 1-5.

American Gas Association, Industrial Gas Section — General Commercial and Hotel and Restaurant Sales Conference, Philadelphia, Pa., March 2-3.

Wisconsin Utilities Association, Gas Section: Commercial and Technical Divisions—Joint convention and manufacturers exhibit, Schroeder Hotel, Milwaukee, Wis., March 15-17.

April

American Gas Association, Distribution Conference—Washington, D. C., April 12-14.

May

Pennsylvania Gas Association—Sky Top Lodge, Sky Top, Pa., May 4-6.

American Gas Association, Natural Gas Department—Civic Auditorium, Kansas City, Mo., May 10-15.

June

American Gas Association, Industrial Gas Section—Industrial Gas Sales Conference, Chicago, Ill., June 8-9.

Canadian Gas Association — 30th Annual Convention, Chateau Laurier Hotel, Ottawa, Canada, June 10-11.

American Society of Heating and Ventilation Engineers — New Ocean House, Swampscott, Mass., June 24-26.

October

American Gas Association—October 11-16.

American Society for Metals—1937 Metal Congress and Exposition, Atlantic City Auditorium, Atlantic City, N. J., October 18-21.

SELECTING A NATURAL GAS ENGINE

By C. REMSCHEL
Power Engineer, Southern Counties Gas Company

THE average business man who has decided to purchase a natural gas engine is usually not familiar with its design or limitations, and in consequence is unable to judge properly or weigh correctly the different claims made by the engine salesman.

C. REMSCHEL

It is true that a gas engine designed for one purpose will not necessarily give good results when applied to a service for which it was not designed. Therefore, gas engines are usually designed for a particular class of service and when used for that purpose give good results.

The following information is for the purpose of familiarizing the prospective purchaser in a general way with the design and the limitations of the modern conventional gas engine so that he may be better prepared to select an engine best suited for his needs.

Gas engines have their limitations, the principal ones being speed (revolutions per minute or piston speed) and horsepower output. Recognition of these limitations is of the utmost importance, as abuse will seriously affect the ultimate success of the installation. Both speed and horsepower output should be considered in a conservative way consistent with the duties expected from the engine.

Let us consider first revolutions, or piston speed per minute (stroke in inches x 2 x revolutions per minute divided by 12). The standard practice for this is more or less arbitrary. The more rigid the crank shaft, the greater the bearing surfaces, the lighter the reciprocating parts (such as connecting rods, pistons, etc.); and the more effectively these parts are balanced in rotation, the higher the rotative speed can be. It is the present day custom of most gas engine manufacturers to rate the horsepower of their engine on the basis of the piston travel being at the rate of 1000 feet per minute.

Under certain conditions this speed may be increased materially provided the period of operation is not too long, as in the operation of hoists, drag lines, etc.; where this high speed is intermittent for short periods and usually with a light load. On the other hand, there are instances where the piston speed can be reduced to an advantage in cases where the load and speed are constant, as in pumping or operating an electric generator, etc. It has been our experience that an engine will give better service when operating at 900 feet per minute piston speed, the maintenance being less and the engine usually operating more quietly and appearing smoother.

The horsepower of an engine varies practically in direct proportion to the speed, consequently one cannot afford to operate the engine at too low a speed as that would increase the first cost per horsepower of the engine. Also, after the speed has been reduced to a certain point, still lower speed is of no great advantage, especially in the already slow running engines. In the short-stroke high-rotation speed engines, the advantage of speed reduction is very much more noticeable, and from this it appears that the reduction in the number of reversals of the direction of piston travel is more noticeable than the reduction in piston speed.

In view of the above, it is recommended that when an engine is installed where the hours of operation are long, and dependable service is necessary, that the engine be operated not over 900 feet per minute piston speed. On the other hand, where an engine is for intermittent or standby service, the engine can frequently be safely operated under favorable conditions at 1000 or even 1500 feet per minute piston speed.

A gas engine obtains its power from the expansion of the products of combustion produced by the burning of the fuel in the combustion chamber or cylinder of the engine; the more fuel that is being burned, the more power that is developed.

For every 100 per cent of heat supplied to a gas engine as fuel, 25 to 30 per cent does useful work. The bal-

During the past several months GAS has received numerous requests from readers for further information on the subject of gas engine power. The paper by Mr. Remschel herewith published is the first of a series in answer to these requests. The February issue will carry an article on "Results Obtained from Burning Natural Gas in an Automotive Engine" by M. M. Heller of the University of Texas. From month to month throughout 1937 further discussions on this subject will be presented to the readers of GAS. — EDITOR.

TABLE NO. 1. PISTON SPEED AND REVOLUTIONS

Stroke Inches	Piston Speed in Feet per Minute 800	900	1000	1100	1200
4.00	1200	1350	1500	1650	1800
.25	1129	1270	1411	1552	1693
.50	1066	1200	1333	1466	1600
.75	1010	1136	1263	1389	1515
5.00	900	1080	1200	1320	1444
.25	914	1028	1142	1256	1370
.50	872	981	1090	1199	1308
.75	834	939	1043	1147	1251
6.00	800	900	1000	1100	1200
.25	768	864	960	1056	1152
.50	738	830	923	1015	1107
.75	711	800	888	977	1065
7.00	685	771	850	935	1020
.25	662	744	827	909	992
.50	640	720	800	880	960
.75	614	696	774	851	929
8.00	600	675	750	825	900
.25	581	654	727	800	872
.50	564	635	704	774	845
.75	548	616	685	753	822
9.00	533	600	666	733	800
.25	518	583	648	778	713
.50	505	568	631	694	757
.75	492	553	615	676	738
10.00	480	540	600	660	720
.25	468	526	585	643	702
.50	457	514	571	628	685
.75	446	502	558	614	670
11.00	436	490	545	600	654
.25	426	480	533	586	640
.50	417	469	521	573	625
.75	408	459	510	561	612
12.00	400	450	500	550	600
.25	391	440	489	538	587
.50	384	432	480	528	516
.75	376	423	470	517	564
13.00	369	415	461	507	553
.25	361	407	452	497	542
.50	355	400	444	488	532
.75	349	392	436	480	523
14.00	342	385	428	471	513
.25	336	379	421	463	505
.50	330	370	413	454	495
.75	325	365	406	446	487
15.00	320	360	400	440	480
.25	314	353	393	432	471
.50	310	348	387	425	464
.75	304	342	380	418	456
16.00	300	337	375	412	450
.25	295	332	369	406	443
.50	290	326	363	399	435
.75	286	322	358	394	430
17.00	281	317	352	387	422
.25	277	312	347	381	416
.50	274	308	342	376	410
.75	270	304	338	372	405
18.00	266	300	333	366	400

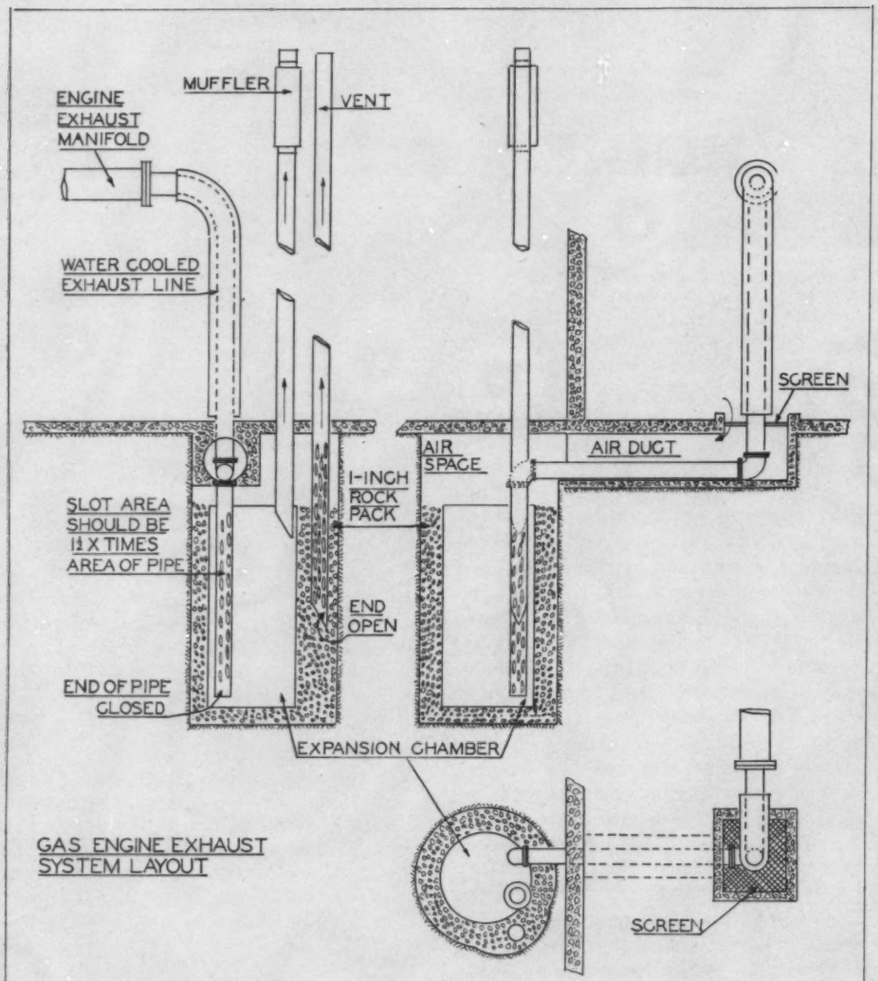


FIG. 1

ance is about evenly divided between, and dissipated or lost in, the exhaust gas and the cooling water.

There is a limit to the amount of heat that an engine can dissipate, and the horsepower output is dependent upon this factor. All of the heat going out of the exhaust must pass through the exhaust valves; the more heat that passes through these valves, the hotter they become. If the allowable limit is exceeded, the valves burn, requiring attention and perhaps replacement.

The heat that can be absorbed by the cooling system is limited by the area of the combustion chamber in the cylinder and combustion chamber's ability to transmit heat. The more heat that the inner wall of the cooling water-jacket has to transmit, the hotter it becomes and the greater the expansion of the metal in this wall. The cooling water passing through the cooling water-jacket tends to keep the outside wall comparatively cool, and if the temperature difference between these walls becomes too great it causes stresses which may exceed the yield point of the metal and necessitate a new cylinder or cylinder head. This can be avoided by not overloading the engine and by adequate circulation of cooling water.

The load on a gas engine may be expressed in terms of pounds of mean effective pressure per square inch. Mean effective pressure is the average pressure on the piston during its working stroke. The horsepower output of an engine, the mean effective pressure, and the heat that must be dissipated all vary in direct proportion to each other.

The present day practice in rating the horsepower output of an engine by the manufacturer, seems to be arbitrary. Some rate their engines on the basis of 75 pounds mean effective pressure, while others go as low as 65 pounds mean effective pressure. As the mean effective pressure varies directly as the horsepower, it is evident that the lower the mean effective pressure the higher the first cost per horsepower.

From experience we have learned that the average present day gas engine can carry its load satisfactorily if the engine is not rated over 75 pounds mean effective pressure. However, it is our opinion that better service can be obtained if the mean effective pressure does not exceed 70 pounds.

At this time we would like to caution the prospective purchaser to give due consideration to future power requirements. Be sure that the engine purchased is of sufficient capacity so that the engine will not have to be replaced with a larger one too soon.

In view of the above information it would be our recommendation that gas engines be purchased and installed in accord with the following ratings:

(1) Constant Load Continuous Operation, 70 pounds MEP not over 900 feet per minute piston speed.

(2) Constant Load, Intermittent Operation, 70 pounds MEP, 1000 feet per minute piston speed or over as warranted.

(3) Intermittent Load, Continuous Operation, 75 pounds MEP (Max.) not over 900 feet per minute piston speed.

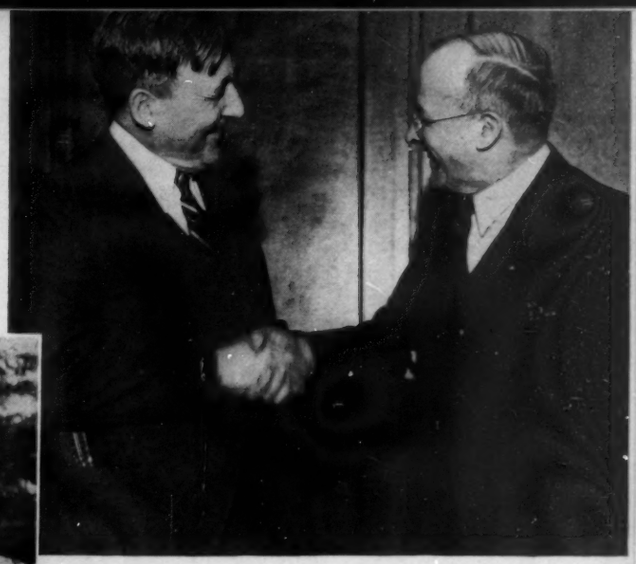
(Continued on Page 36)

TABLE NO. 2. HORSEPOWER PER CYLINDER

Bore Inch	900 Ft. Piston Speed 70 lb MEP	900 Ft. Piston Speed 75 lb MEP	1000 Ft. Piston Speed 70 lb MEP	1000 Ft. Piston Speed 75 lb MEP
3.00	3.40	3.78	3.64	4.05
.25	3.99	4.43	4.27	4.75
.50	4.63	5.14	4.96	5.51
.75	5.31	5.90	5.69	6.32
4.00	6.04	6.72	6.48	7.20
.25	6.82	7.58	7.31	8.12
.50	7.65	8.50	8.20	9.11
.75	8.52	9.47	9.13	10.15
5.00	9.45	10.50	10.12	11.25
.25	10.41	11.57	11.16	12.40
.50	11.43	12.70	12.25	13.61
.75	12.49	13.88	13.38	14.87
6.00	13.60	15.12	14.58	16.20
.25	14.76	16.40	15.81	17.57
.50	15.97	17.74	17.11	19.01
.75	17.22	19.13	18.45	20.50
7.00	18.52	20.58	19.84	22.05
.25	19.86	22.07	21.28	23.65
.50	21.26	23.62	22.78	25.31
.75	22.70	25.22	24.32	27.02
8.00	24.19	26.88	25.92	28.80
.25	25.72	28.58	27.56	30.62
.50	27.31	30.34	29.26	32.51
.75	28.93	32.15	31.00	34.45
9.00	30.61	34.02	32.80	36.45
.25	32.34	35.93	34.65	38.50
.50	34.11	37.90	36.55	40.61
.75	35.93	39.92	38.49	42.77
10.00	37.80	42.00	40.50	45.00
.25	39.71	44.12	42.54	47.27
.50	41.67	46.30	44.65	49.61
.75	43.68	48.53	46.80	52.00
11.00	45.73	50.82	49.00	54.45
.25	47.83	53.15	51.25	56.95
.50	49.99	55.65	53.56	59.51
.75	52.18	57.98	55.91	62.12
12.00	54.43	60.48	58.32	64.80

GAS CAMERA

HITTING the BALL at Brentwood, Santa Monica, Calif., are Jim Reed, Cooper-Bessemer; Cal Payne, American Meter Co., Denver; Elting Henderson, So. Calif. Gas Co.; and Jack Delaney, Reliance Regulator Corp.



CONGRATULATIONS: J. P. Pulliam, president of Wisconsin Public Service Corp. felicitates C. R. Phenicie, vice-president, on his completion of 25 years service with the corporation at a surprise testimonial dinner in Green Bay, last month.

BANQUETEERS: Shown at right are members of the sales department of the Dallas Gas Co. being entertained by A. S. Kincaid, Ward Heater Co. representative in Dallas.

RUINED BRUIN: Below is shown Rochester Gas and Electric Co.'s Vice-president Joseph P. Haftenkamp and his first bear, a 200-pound black bruin, bagged on a recent hunting trip north of Ottawa, Canada.

EXPERIMENT: To promote public relations, The Peoples Gas Light & Coke Co., Chicago in its remodeled 63rd street store has provided a large table, numerous comfortable chairs for customers to see application clerks.

The Sales Value And Industrial

By J. P. LEINROTH

WE in the gas industry who recall the older methods of using gas for industrial and commercial purposes, as these methods existed only a few years ago, can readily appreciate the value of the progress and vastly increased acceptance of gas in these fields.

We know, too, that this increased acceptance of gas, largely at the expense of other fuels, is due primarily to progressive and continuous research and development that have brought about more efficient equipment, improved processes and new methods for using gas.

J. P. LEINROTH

There is another fact that is equally well known, but we wonder if its significance is fully realized—the fact that most of this new progress in gas utilization has been made during the past five years, to meet the demands of industry and commercial establishments faced with the necessity for reduced costs, increased efficiency, and better quality that would enable them to meet the highly competitive situations during these lean years.

Because there was no industry advertising of gas for industrial and commercial purposes during this period, and because publicity programs reaching these fields were rather limited due to the fact that many trade paper publishers greatly reduced the number of their editorial pages, the story of the new development in up-to-date gas utilization was told only very sketchily to the industrial and commercial fuel markets.

The Gas Industry, therefore, finds itself in the position of having developed a "product with many merits" during a time when the market was lean. Now, with a rich market opening up, the task of utmost importance is to tell that market the story of the "product" we have to sell—Gas, for industrial and commercial uses.

The telling of this story through business and trade paper advertising is the objective of the advertising campaign now being sponsored by the American Gas Association, Industrial Gas Section, in connection with the national advertising campaign under the supervision of the Committee to Conduct National Advertising.

Industrial and commercial advertising is making the prospect realize more definitely than ever before that the gas industry is alert and progressive and modern; that through its research and development activities, it has developed important new information about gas and gas utilization; that out of this new knowledge of gas has come new and more efficient equipment; and that this new information and new equipment not only make gas available for many industrial and commercial processes on a more economical basis than ever before, but also make possible definite improvements in quality of product and substantial reductions in cost.

In addition, the advertising constantly sells the merits of gas as a fuel—its flexibility; its controllability as to both temperature and furnace atmosphere; its cleanliness; its instant availability and its quick-heating character; its suitability for a wide variety of applications; its saving in storage, handling, space and labor costs; and its over-all economy and efficiency.

All these arguments for industrial gas culminate in one appeal which is of universal interest . . . *profits*. The advertisements show how gas gives many advantages over other fuels, and how the results of gas utilization help make profits.

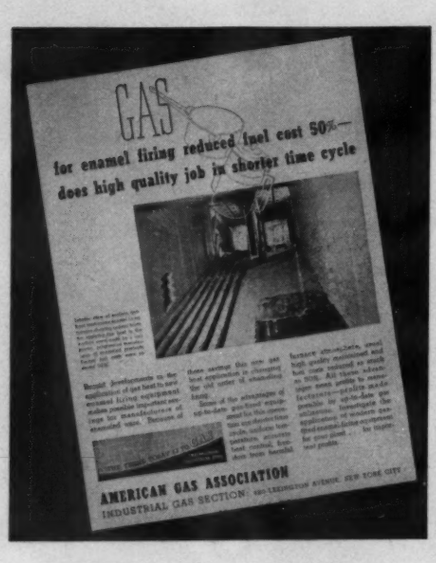
This phase of the national advertising comprises, in effect, eight separate and distinct campaigns, each directed to a separate industrial or commercial field. The fields are covered with metal working, ceramic, enameling, glass, baking, food processing, commercial cooking and beauty parlor. Each separate campaign features advertisements showing specific types of modern gas equipment of interest to heat users in the field covered—telling how gas used in modern equipment is making profits for the user.

Fourteen leading industrial and commercial publications are being used, as follows:

American Hairdresser, American Restaurant, Bakers' Helper, Bakers' Weekly, Ceramic Industry, Food Industries, Glass Industry, Hotel Management, Industrial Gas, Iron Age, Metal Progress, Metals and Alloys, Modern Beauty Shop, Steel.

These publications were chosen after a careful analysis of all publications serving these fields, and they give maximum coverage. The combined circulation during the 12 months duration of the campaign directs a total of 1,725,989 full page gas advertisements to persons specifically interested in the industrial and commercial applications of heat.

Specific advertisements directed to each of the selected fields carry messages of pertinent interest to individuals in those fields. For example, advertising directed to the metal-working industry describes the advantages of gas for carburizing, normalizing, annealing, galvanizing, melting, forging, drawing, etc.,


GAS
for enamel firing reduced fuel cost 50%—
does high quality job in shorter time cycle
AMERICAN GAS ASSOCIATION
INDUSTRIAL GAS SECTION

● **The profit advantages offered by modern gas equipment is pointed out in this advertisement directed to the ceramic industry. The use of gas hot tubes for enameling is featured. It is emphasized that new gas equipment is doing a better job, more economically. This page appears in "Ceramic Industry."**

● **This advertisement primarly features the many advantages of gas as a fuel for baking. This timely advertisement which is one of a series currently appearing in "Bakers' Weekly" and Bakers' Helper" details how the results of modern gas baking equipment will bring increased profit to bakers.**

● **This advertisement, one of a series appearing in "Steel," "Iron Age," "Metal Progress," "Metals and Alloys" and "Industrial Gas," is directed to the metal working industry. It tells how the use of gas in the automotive industry increased 105 per cent and prompts readers to note the advantages of gas.**

● **The advantages offered by gas fuel in the form of profits for cooking are featured in this advertisement. In the food industry gas is used for process heating jobs, and the advertisement points out that gas is doing the job efficiently and economically. "Food Industries" magazine, 37,000 circulation, is used.**

Of Commercial Gas Advertising

Chairman, Advertising Committee, A.G.A. Industrial Gas Section

and shows how gas makes controlled atmospheres practical and economical for many heat-treating operations throughout this very important industry.

Advertisements directed to beauty parlors emphasize the advantages of gas for hair drying, water heating, refrigeration, space heating and air conditioning. And bakers everywhere see gas advertisements telling them why gas is the best fuel for baking. Likewise, the food industries are reading advertisements prepared especially to tell them of the growing use of gas for the many heating processes throughout this vast industry. And still another series informs hotels and restaurants about the many ways that gas is becoming more and more the leading commercial cooking fuel.

In every one of these series definite statements are made telling the reader about other users in his field who have profited by using gas; how up-to-date equipment, new knowledge of gas utilization and new methods are resulting in better quality, improved results, greater savings, lower over-all costs, new profits, etc.

The industrial and commercial phases of the advertising campaign this year are particularly timely. In the first place, industrial and commercial establishments everywhere are today on a sounder financial basis than they have been for many years. Their business is better, profits are larger, and they have more money to spend. Advertising, therefore, is reaching a market that is more responsive than it has been for some years. This, of course, means a greater opportunity for producing results.

In the second place, today's trend toward modernization of plants and equipment—a trend which has already attained considerable momentum—assures a fertile market for gas. Advertising is being used effectively to point out how gas can be used in modernization programs, to cut costs and improve quality.

The Gas Industry at present enjoys a large and profitable load in the industrial and commercial fields. To do no more than hold that load against the attacks of competitive fuels requires eternal vigilance and keen and aggressive selling. Advertising is helping in this direction.

To expand that load in new fields and in new applications requires extra effort. Here again advertising is helping, because there are many industries to which the story of gas has never been properly or adequately told but which are now, for the first time, being reached by this business and trade paper advertising. There are many present users of gas who could profit by modernizing their plants with some new and more efficient gas equipment developed during the past few years. These users are learning about these new developments through the industrial and commercial gas advertising.

Local Tie-Ins

It can readily be seen that there are many opportunities for this advertising to work for its sponsors. One very important way has recently been pointed out by the committee. That is the effective local circularization of reprints of the advertisements. It is suggested, for example, that gas companies send letters to their industrial and commercial prospects enclosing with these letters reprints of Industrial Gas advertisements that are of special interest to the prospect or customer. This plan has frequently been used successfully in the sale of gas and gas-fired equipment. One manufacturer, for instance, got his first sale of a certain type of gas-fired equipment to a large, well known automobile manufacturer as a result of an inquiry coming from such a mailing. Prior to the inquiry, the equipment manufacturer's salesmen were not even permitted to tell their story to the proper parties, yet the inquiry came from a high official. That sale led to a large and valuable gas load. Scores of other sales have resulted from the intelligent use of this type of promotional material.

The Advertising Committee of the Industrial Gas Section earnestly recommends that gas companies take every advantage of this advertising to help their own local situation, and to get the most value from each advertisement that is directed to customers or prospects in his locality.

The Industrial and Commercial phases of the National Advertising campaign are supervised by the Advertising Committee of the Industrial Gas Section composed of: J. P. Leinroth, chairman, Public Service Electric & Gas Co., Newark, N. J.; F. B. Jones, vice-chairman, Equitable Gas Co., Pittsburgh, Pa.; C. Cassidy, The Peoples Gas Light & Coke Co., Chicago, Ill.; R. M. Keeney, The Connecticut Light & Power Co., Hartford, Conn.; Henry Obermeyer, Consolidated Edison Co. of New York, N. Y.; T. H. Spain, Public Service Electric & Gas Co., Newark, N. J. This committee is responsible, in matters of national advertising, to the Committee to Conduct National Advertising, T. J. Strickler, chairman, and Henry Obermeyer acting as liaison officer. Ketchum, MacLeod & Grove, Inc., of Pittsburgh, Pa., are the advertising agents.

RELIEF VALVES . . .

By F. A. HOUGH

Southern Counties Gas Company*

THE most important step in the installation of a pressure-relieving device is the selection of the device itself. To intelligently select such a device for a given set of conditions, it is necessary to have clearly in mind the operating characteristics and limitations of the various available types. For this reason, a considerable portion of this paper is devoted to a discussion of the operating characteristics of relief valves. Brief mention is also made of other devices for relieving pressures such as back-pressure regulators, explosion heads, and mercury-seal relief valves.

F. A. HOUGH

The manufacturers of relief valves make a distinction between valves used on pressure vessels containing fluids other than steam, and those used on boilers. They call direct spring-loaded valves for use on steam boilers, safety valves; and direct spring-loaded valves for use on pressure vessels containing other fluids, relief valves. Two names are employed because the operating limits specified by the A.S.M.E. Boiler Code are much narrower than those specified by unfired pressure-vessel codes. However, the distinction is not an important one as valves of the same type are often used for both purposes. The various pressure vessel codes do not make the distinction, so all direct spring-loaded valves intended for relieving pressure are referred to in this paper as relief valves.

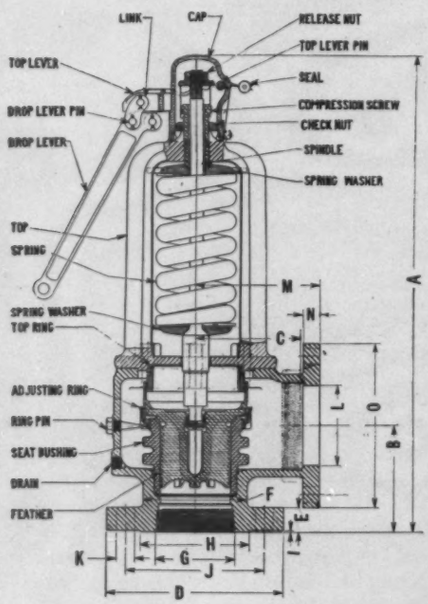


FIG. 1

Operating Characteristics

A cross section of a relief valve of widely-used type is shown in Fig. 1. Consider the operation of a valve of this type when connected to a vessel in which the pressure is increasing very slowly. The valve will start to open when the pressure times the exposed area of the disc equals the force exerted by the spring. If the valve were a simple valve, it would tend to close again as soon as it opened because the flow through the valve would lower the pressure under the disc. This tendency is offset in the valve shown in Fig. 1 by the throttling action between the outer edge of the valve disc and the adjusting ring. As a result of this action, as soon as the valve opens fluid pressure is exerted over a much larger area than before the valve opened. Consequently, although the pressure per unit area is less, the total force acting on the disc is greater after opening than before. As a result, the valve pops to a relatively high position and its discharge capacity is greater than is the capacity of a simple valve. If the original pop does not provide sufficient discharge port area to stop the gradual increase in pressure in the vessel, a further increase in pressure will compress the spring and raise the valve still higher, thus providing additional relief capacity, until finally the area of the cylindrical discharge port under the disc equals or exceeds the free area of the throat. Further lifting of the valve disc will not increase the rate of discharge and the valve will then act as a fixed orifice.

Since the disc presents a larger area to the fluid presssure when the valve is open than when it is closed, it follows that the reseating pressure must be lower than the opening pressure. The difference between the opening and reseating pressure is called the blow-down. The amount of blow-down can be adjusted within limits by raising or lowering the adjusting ring.

A similar valve of slightly different design is shown in Fig. 2. The adjustment of the blow-down is accomplished in this case by changing the size of ports leading from the supplemental pop chamber to the outer chamber. If these ports are small, the pressure under the outer rim of the valve will be high, causing a relatively high lift and a large blow-down. Opening these ports will permit gas to flow from the inner to the outer chamber, thus lowering the pressure under the outer rim of the valve and reducing the lift and also the blow-down.

Figure 3 shows an improved type of valve, having several advantages over the types already discussed. The lift of this valve for small increases in pressure above the opening pressure is considerably more than the lift of the other types. A study of Figs. 3 and 4 will disclose the reason for this greater travel. When the valve opens, a larger area of the disc is subjected to fluid pressure than when the valve is closed, just as was the case with the valves previously described. However, in this case, after the valve has lifted a little, the issuing fluid strikes the adjusting ring and is deflected downward, as shown in Fig. 4. As a result, a reaction effect is produced which tends to increase the valve lift. This added lifting force does not tend to increase blow-down, because after the lower face of the disc returns to the plane the lower edge of the adjusting ring when the valve is closing, the reaction effect disappears. Blow-down is regulated by raising or lowering the adjusting ring. A secondary adjustment of blow-down is obtained by raising or lowering the nozzle ring. A valve of this type when operating on steam, will lift high enough by the time the pressure has increased to 3 per cent above the set pressure, to give the full capacity of the nozzle.

The design shown in Fig. 3 has a number of other advantages in addition to the high lift. There are no guides below the disc. Consequently a highly efficient discharge nozzle can be employed which is considerably smaller for a given capacity than the throat of bottom-guided valves. As a result, for the same capacity, smaller springs can be employed and less difficulty is encountered in lapping in the valve.

---

*Presented before the Southern California Meter Association, December 17, 1936.

† "Fundamentals of Safety-Valve Design," R. J. S. Pigott, *Power*, April 19, 1927.

Their Installation and Maintenance

The relatively small area of the nozzle and the through nozzle construction also reduce distortion due to temperature and installation strains. A study of Fig. 5 will help to gain an understanding of why relief valves behave as they do. This chart is reproduced from an article by R. J. S. Pigott†. Each of the (a) curves shows the force exerted on a given relief valve disc for different positions of the disc above its seat by a fluid under constant static pressure. Each (a) curve represents conditions for a different fluid pressure. The shape of the (a) curves is fixed by the design of the valve and by the position of the blow-down adjusting ring.

The (b) curve shows the force exerted by the spring for different positions of the valve disc. The location of this curve is fixed by the spring adjustment, and its slope is fixed by the design of the spring. Curve (b) intersects (a) curve No. 1 on the "y" axis. Since at this intersection, the force exerted on the disc by the fluid pressure just equals the force exerted by the spring, the disc will start to rise. But, as it rises, the force exerted by the fluid pressure increases faster than does the force exerted by the spring and so the disc "pops" up to a lift slightly greater than D/16. At that lift, the (a) and (b) curves intersect. This means that the force exerted by the spring again equals the force exerted by the fluid pressure under the disc. Equilibrium is established at this point, and as long as the fluid pressure remains constant the disc will not move. However, if the pressure in the vessel tends to rise, the force tending to lift the disc will increase and the disc will rise till equilibrium is again established. If the pressure in the vessel tends to fall, the disc will drop until equilibrium is again established. Finally, with a continued drop in pressure, an (a) curve will be obtained which is tangent to curve (b). Equilibrium at the point of tangency is unstable because, for lifts below this point, the force exerted by the spring exceeds the force under the disc. Consequently, the valve snaps shut.

Another characteristic of relief valves should be emphasized. When a valve is closed and the pressure under the disc is near the set pressure, the resultant force tending to hold the disc on its seat is quite small. Consequently, there is a tendency for valves to leak just before they pop.

The following quotation is taken from the catalog of one manufacturer of relief valves: "The working pressure on relief valves used on air or dry natural gas should not exceed 75 per cent of the set pressure if perfect tightness under operating conditions on such service is desired."

This is an important limitation in the use of relief valves and one that is often overlooked. Such a limitation causes at times the sacrifice of costly pressure vessel or pipe line capacity, and has led to the use of other types of pressure-relieving devices.

Now, to summarize relief valve characteristics and define terms: Our discussion thus far has disclosed the following:

1. All relief valves require a pressure higher than the opening pressure to force them open far enough to give a good discharge capacity. The difference between the opening pressure and the pressure finally attained is called "accumulation."

2. All relief valves reseat at a lower pressure than that at which they open. The difference between the opening pressure and the reseating pressure is called "blow-down."

3. All relief valves tend to leak just before they open. This leakage is called "warn."

While all relief valves have these characteristics, the amount of accumulation, blow-down, and "warn" will vary widely depending upon the design of the valve and its condition.

The selection of a valve for a particular service will depend upon the amount of accumulation, blow-down and "warn" permissible. Two examples will serve to illustrate the point:

Consider a relief valve to protect a group of high-pressure holders having a net capacity of 3,000,000 standard cubic feet of gas, and a designed maximum working pressure of 50 pounds per square inch. Assume that good engineering practice requires that at no time shall the pressure in the holders be permitted to go higher than 55 pounds per square inch. The maximum pressure at which the holder can be operated will then be the pressure at which a relief valve will just start to leak when set so that it will hold the holder pressure down to 55 pounds per square inch. A reduction of 1 pound in the difference between this maximum operating pressure and 55 pounds per square inch would add holder capacity worth $6,600. (The capacity of a high-pressure holder varies directly as the maximum operating gauge pressure.) Under these circumstances, the installation of the very best relief valves available is justified.

Now, consider a relief valve to protect a large displacement meter having a designed maximum working pressure

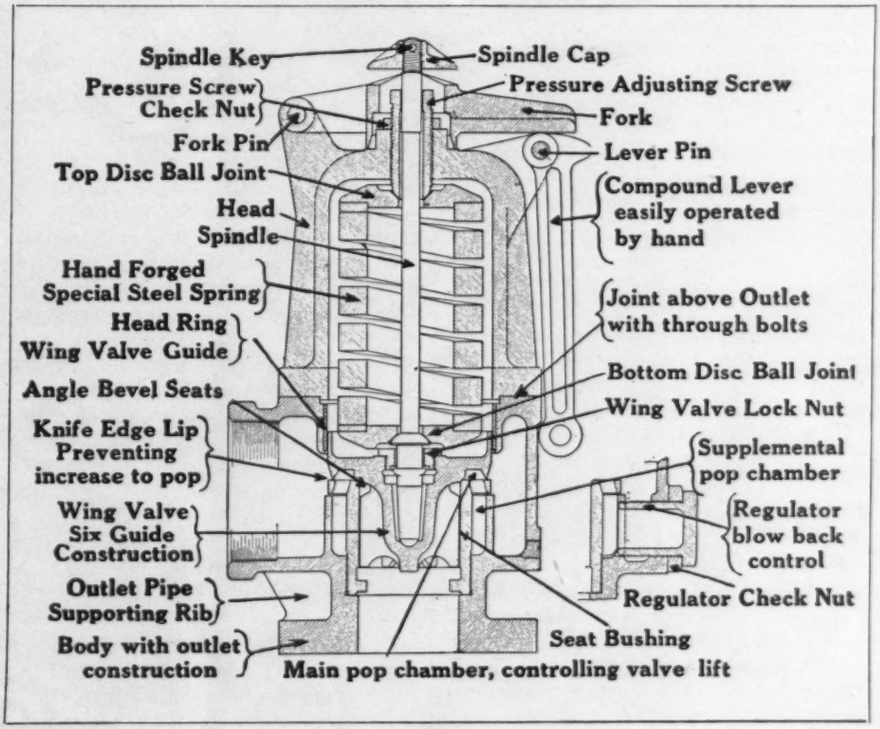


FIG. 2.

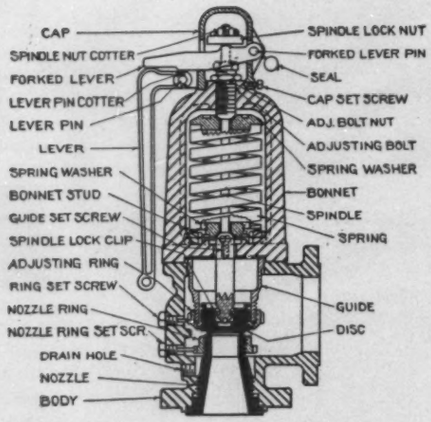


FIG. 3

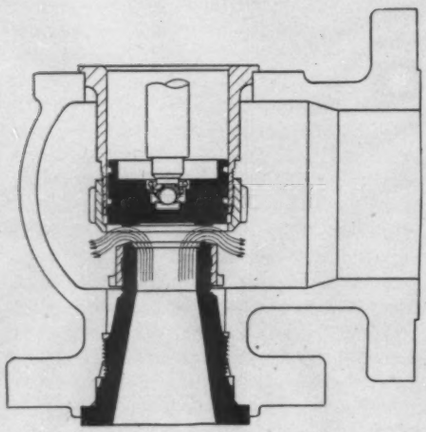


FIG. 4

of 75 pounds per square inch, but set at a location where the maximum possible operating pressure is 25 pounds per square inch. Under these conditions, a very crude valve can be used, the most important requisites being that it not leak at 25 pounds per square inch pressure, and that it have no tendency to stick shut.

Relief Valve Capacities

Two problems concerning capacity are involved in each installation. One is the determination of the total discharge capacity required to hold the pressure to the specified limit and the other is the determination of the size valve or the number of valves of a given size and make required to give that capacity.

The required relief valve capacity for a boiler is obviously equal to the rate of steam generation when fuel is being burned at the maximum possible rate. The adequacy of a given relief valve installation can be tested by closing all steam outlets in the boiler and firing the boiler at as high a rate as possible.

The required relief valve capacity for an air receiver is equal to the maximum rate at which the compressor can deliver air to the receiver. The required relief valve capacity for a high-pressure gas holder is equal to the maximum rate at which gas can be delivered to the holder by the existing transmission lines and regulating equipment. The required relief valve capacity for a butane storage tank is fixed by either the delivery capacity of the pump used to fill the tank or by the possible rate of heat transfer into the tank should it be involved in a fire.

See Table No. 1 for relief valve capacities required by the various pressure vessel codes.

The capacity of relief valves can be determined best by test. It should be possible to compute the capacity of a relief valve if the dimensions of the valve and the lift are known; and formulae are given in the A.S.M.E. Boiler Construction Code and Unfired Pressure-Vessel Code for the computation of relief valve capacities. However, a series of tests was run recently by the steam engineering laboratory of the Ohio State University at the request of the National Board of Boiler and Pressure-Vessel Inspectors. All the valves tested carried a plate showing the manufacturer's rating of the valve for a 3 per cent accumulation, which is the accumulation specified for this purpose by the A.S.M.E. Boiler Code. The results of these tests showed that the actual capacity of 14 out of 18 valves tested varied from 15.7 to 79.7 per cent of the rated capacities computed by the manufacturers by means of the A.S.M.E. Boiler Code formula. Four valves were found to have actual capacities ranging from 97 to 115 per cent of the manufacturer's rating. It was found that the valves in this latter group were rated by the manufacturer by means of capacity tests, and not by computation. The error in the computed capacities may be due to the restricting effect of the valve guides in the throat of the discharge nozzle, which would cause a lower pressure at the valve disc than is assumed in the A.S.M.E. formula or to inaccuracies in estimating valve lift. Regardless of the causes, it is quite evident that relief valve capacities cannot be computed with certainty by means of published formulae, and that any capacity tables supplied by manufacturers based solely on such formulae are not to be relied upon.

The discrepancy between the rated capacities and the capacities found in the Ohio State tests is not as serious a matter as it might at first seem, since it is quite probable that all the valves tested would attain the rated capacity at an accumulation slightly higher than the very low accumulation specified by the Boiler Code.

A relief valve capacity rating which does not also specify the per cent accumulation, is a meaningless figure.

In ordering relief valves, the permissible accumulation should be specified and the buyer should insist that the relief valve be rated by actual test rather than by computation.

Table No. 1 gives the relief valve accumulation permitted by the various pressure-vessel codes likely to apply to any installation in California.

Non-Standard Types of Pressure Relief Devices

Our discussion thus far has dealt with direct spring-loaded relief valves of standard design, which is the type required by all the pressure-vessel codes, with the exception of the A.P.I.-A.S.M.E. code which specifies that such valves must be used if the pressure originates in the vessel to which the relief

(Continued on Page 40)

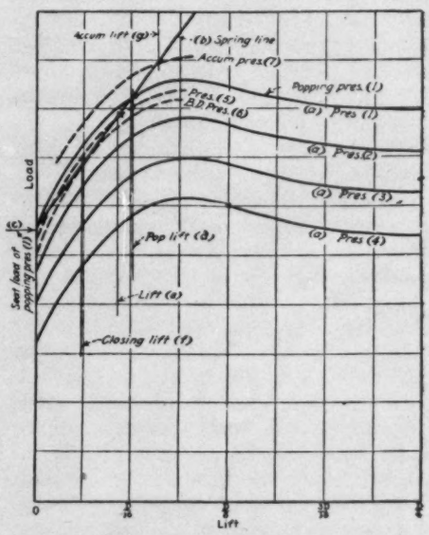


FIG. 5. Graphical analysis of safety-valve operation by load lift diagrams.

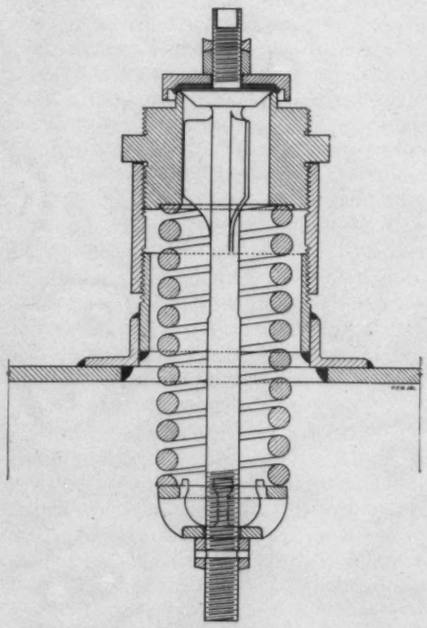


FIG. 6. Relief Valve with removable composition seat.

TABLE NO. 1—COMPARISON OF CODES CONCERNING RELIEF VALVES

REGARDING	*API-ASME Code—Unfired Pressure Vessels, 1934*	*California Liquefied Petroleum Gas Safety Orders, 3-12-34*	*Air Pressure Tank Safety Orders California Industrial Accident Commission 1928*	*ASME Boiler Code—1930*	*ASME Unfired Pressure Vessels Code—1934*
1) Type of pressure vessel	Unfired pressure vessels for petroleum liquids and/or gases where metal temperatures are less than 1000°F.	Pressure vessels for liquefied petroleum gases having vapor pressures exceeding 25 lb./sq. in. ICC containers excluded	Compressed air tanks only	Power boilers operating at 100 lb./sq.in. pressure or more	Unfired pressure vessels for which (P—15) (D—4) >60 and (P—15) (V—1.5) >22.5 Where P=pressure lb./sq.in. D=inside diam. (in.) V=volume, cu.ft.
2) Type of valve required	Direct spring-loaded, or rupture disc. If pressure originates outside of vessel, any device that will prevent pressure from exceeding 10% of maximum allowable w.p.	Direct spring-loaded valves only or plus rupture discs (set at 150% of max. w.p.) and/or fusible plugs (melt at 200°F.)	Direct spring-loaded. Cast iron seat or disc not permitted	Direct spring-loaded. Deadweight or weighted lever valves are not approved	Direct spring-loaded. Cast iron seat or disc not permitted
3) Set pressure	Maximum allowable w.p. for which vessel was designed.	Maximum allowable working pressure of tank	Maximum allowable w.p. of tank	Maximum allowable working pressure of boiler	Maximum allowable w.p. of tank
4) Permissible accumulation	10% of set pressure		10% above max. w.p. of tank	6% of set pressure	10% above max. w.p. of tank
5) Required discharge capacity	Discharge max. vapors that can be generated within the variations of normal operations with an accumulation of 10% of set pressure	Above ground tanks. 100 lb. vapor/hour per sq.ft. of surface area of tank. Single tanks permanently installed at least 200 feet from bldg. and combustible material require 25% of above capacity. Min. size 1" for tanks 300 gal. cap. or more Above ground and underground tanks. Liquid discharge cap. at 10% above max. w.p. equal to capacity of liquid pump used to fill tanks. Min. size of relief valves for underground tanks=1"	Sufficient to limit pressure to 10% above max. w.p. of vessel	Sufficient to limit set pressure to 6% above max. w.p. of boiler Minimum shall be not less than 6 lb./hr./sq.ft. of heating surface or water-tube-boilers, or 5 lb./sq. ft./hr. for all other types of power boilers	Sufficient to limit pressure to 10% above maximum safe working pressure of vessel
6) Equation for capacity	$W=306\ ap\sqrt{M/T}$ Where: W=discharge in lb./hr. a=effective area in sq.in. p=absolute pres. of vapor under valve in lb./sq.in. M=molecular weight of vapor discharge T=abs. temp. of vapor discharge For high lift nozzle safety valves, $a=0.7854d^2$ Where: d=throat dia. in inches For low lift safety valves, $a=2.22dl$ Where: d=inside dia. of valve seat in inches, and l=valve lift in inches	$a=0.77A/p$ Where: a=minimum permissible free discharge area (sq.in.) Free discharge area of relief valve=inside circumference of seat multiplied by lift at discharge pres., but not more than smallest clear area of the nozzle or inlet pipe; or discharge cap. can be taken as manufacturer's rating for air in cu.ft./min. at 68°F at the max. w.p. of tank multiplied by 7.6 to give lbs./hr. of gas mixture A=total outside area of tank p=max. allowable w.p. of tank (lb./sq.in. abs.)	Same as ASME Unfired Pressure Vessel Code, 1934	Definition of safety valve cap.=cap. when pressure is 3.0% above set pressure and blow-down does not exceed 4% of set pres. Blow-down must not be less than 2% of set pressure W=50 x p x A for seats of any angle Where: W=lb. of steam/hr. p=abs. pres. in boiler, lb./sq.in. D=inside dia. of valve seat, in. L=vertical lift of valve disc, measured with 3% excess pressure (inches) A=relieving area=π x D x L x sine of seat angle	Q=28 PD1 for 45° bevel seat valves, and Q=40 PD1 for flat seat valves Where: Q=discharge in cu.ft. of free air/min. P=abs. pres. at which safety valve opens D=dia. in inches of inside edge of bearing surface between disc and seat l=vertical lift of safety valve disc from seat, in inches, representing lift for minimum discharge cap. for satisfactory operation of valve
7) Valves between relief and vessel	Not permitted if source of pres. is in vessel unless locked open or multiple valves are installed. Permitted if pressure comes from outside source and valve also closes vessel from source of pres.	Not mentioned	Not permitted under any circumstances	Not permitted	Not permitted if pressure originates in vessel. Permitted if source of pressure is without vessel, provided valve also shuts off source of pressure
8) Discharge piping	Permissible press. drop in piping=10% of valve discharge pressure	Discharge 10′ above container, 100′ distant from any flame	Same as ASME Unfired Pressure Vessel Code	Same size as valve outlet or total of valve outlets	Full size, drained, no valve. Securely anchored if elbow exists. Stack for 2 or more valves must have area equal to combined area of valves
9) Frequency of inspection	At least once each year	Not specified	Once each day		Once each day
10) Type of inspection	1) Spring suitable for service 2) Opens at correct pressure	Not specified	Raise disc from seat		Raise disc from seat

TO CREATE PUBLIC ACCEPTANCE FOR GAS

The "Home Service Group" of national magazines which carry the Gas Industry's advertising message to the American housewife.

Success of National Advertising Lies With Cooperating Companies

● **McCANN ERICKSON, INC., Advertising, New York City, address given before regional meetings in connection with the American Gas Association's national advertising campaign during December, 1936.—(Abstract by GAS).**

THE national advertising campaign of the American Gas Association is now under way. Initial advertisements have been greeted with enthusiasm. The next thing to do is to assure their continuing effective operation throughout the country. That is up to those gas companies that are contributing to the campaign, because a successful advertising campaign needs a great deal more than just some nice-looking magazine advertisements. Each company participating in the campaign can capitalize on its contribution to the national campaign and make that contribution show substantial returns right in its own territory.

The theme of the campaign is expressed in a phrase from the resolution that was passed in Chicago last October: "To create public acceptance for gas as the modern, efficient fuel for all household purposes wherever heat is required." The committee that was set up, together with the advertising agency, in developing a basic copy plan, recognized that gas must be given a modern appeal, and also that the burden of the message to the public must be based on something more tangible than gas. Therefore, it was decided to go to the heart of every gas customer and say, first of all: "Modernize your *home* with gas." That is the keynote of the campaign.

To answer the question of the potential customer, "How may I modernize my home with gas, and why should I?" the advertising answers: "There is nothing like gas for cooking, refrigeration, water heating, and house heating."

For each of these functions gas has always had and still has all the attributes of modernity, and these spring from the inherent characteristics of gas and pioneering efforts of the appliance manufacturers. What are those attributes? They are speed, cleanliness, silence, economy, and style.

To present adequately all those points with regard to all the household uses for gas would be a large order. A national campaign must have a sharper focus.

It was decided that the cooking load is the key load of the domestic business. Therefore, the emphasis of the campaign is on cooking, and the aim is, first, to get people to realize that there is nothing like gas for all kinds of cooking—broiling, roasting, baking, frying, and boiling. It was further decided to build the story around the gas range, increasing satisfaction among the 15,000,000 users of gas ranges and whetting the interest of everyone with the idea of "modernizing your home with gas." This campaign is designed to retain the goodwill that gas companies already have, build more prestige, sell more and better appliances, and sell more gas.

National magazines were the media chosen because they offer color, selective circulation, prestige value, long life, and fit the campaign budget. The major portion of the attack is delivered through full-page advertisements in color in a group of five women's magazines, known as the "Home Service Group." These are outstandingly successful for all products used in the home, and their editorial content provides correlated material into which the gas story fits perfectly. Studies show, too, that there is an unusually high degree of correlation between the gas meters in the state and the per cent of magazine circulation.

Since "result" pictures are more attention-getting than appliance pictures, the advertisements feature, for example, a picture of a pie. The copy states that there is nothing like gas for cooking and adds the slogan, "Modernize your home with gas." A series of such ads has begun to appear in the five women's magazines. Results already obtained indicate substantial reader interest from the start.

But there is a broader job to do. Men must be reached, because they have a definite interest in, if not control of, the purchase of modern household appliances. Furthermore, attention must be called to each of the other major gas appliances that are available for home use. To do this, *The Saturday Evening Post* was selected. It is a recognized medium for building prestige, it has broad readership throughout the country—approximately 50 per cent men and 50 per cent women—and it has a circulation today of over 2,900,000 available at the low cost of only a little over a third of a cent per page.

The first of nine advertisements to appear in *The Saturday Evening Post* was carried in the issue of September 8, 1936.

The five women's magazines and *The Saturday Evening Post* carry the gas message to the gas-consuming public in a campaign that has dignity, color, every aspect of modernity, and at the same time a direct good-will sustaining value back of it. It will of itself go a long way toward creating greater public acceptance of gas.

But there are other factors in solving this national advertising problem which

are also of great importance in the building of a well-rounded campaign.

In most sections of the country appliance dealers are becoming of greater value to utility companies because they are starting aggressively to sell modern appliances. And the more modern appliances sold, the greater a gas company's hold on its customers. Therefore, the campaign includes six full pages each in *Plumbing & Heating Trade Journal* and in *Domestic Engineering*. The idea of the advertising in these magazines is to show the dealers that the gas companies are definitely going out to help them fight for and maintain the business in which dealers have invested time and money.

Another important group is that of the architects. There is every indication that a great deal of building will be done in the next several years. If the architect hears and reads about nothing but electricity and electrical appliances, he is not going to do much to foster the use of gas in the new houses that he builds. There will be 12 pages each in *Architectural Forum* and *American Builder and Building Age,* all stressing the fact that there is nothing like gas for cooking, refrigerating, water heating, and house heating, and all carrying the primary slogan, "Modernize your home with gas."

What will gas companies really get in this campaign?

There are going to be 90,000,000 A.G.A. color pages spread over this country during the next year. Ninety-two per cent of that circulation goes into the 1400 counties having domestic gas service, 80 per cent of it goes into towns having a population of more than 2,500.

But a national advertising campaign is not complete just because it has a well-rounded media list with well-laid out pages and well-thought out copy. Other things must be added: Tie-up material merchandising to the dealers; sales promotion material for use at point of sales; and publicity.

Publicity for the newspapers includes photographs from manufacturers and from A.G.A. representatives, mimeographed releases with timely tie-ins, mats to be sent to the smaller papers throughout the country, clip sheets dealing with feature articles, and syndicated news features, not to be sent out hit or miss, but to go to those papers that actually indicate the desire to have them. More than 268 papers are already on the list. Thousands of clippings attest to the fact that newspapers are publishing the various releases sent to them.

Seventy-five radio stations in 44 states are already using the 10- and 15-minute script which goes out periodically. Movie publicity is also being prepared.

Another interesting feature of this publicity effort has to do with correlated advertising. A.G.A. is not the only advertiser that is featuring illustrations of modern kitchens. A serious effort is being made to have as many of those modern kitchens as possible show gas ranges, gas refrigerators.

There it is. A complete co-operative national advertising campaign. It has already started to work. Now what is the Gas Industry going to do with it? Similar association campaigns in the last few years have sometimes failed. Why does association advertising often fail? There are five important "lacks":

1. Lask of a clear-cut definition of the purpose of the campaign.
2. Lack of appreciation of the time necessary to fulfill that purpose.
3. Lack of adequate leadership.
4. Lack of continuing driving force after the first indication of success.
5. Lack of efficient and sufficient tie-up material.

Have these points been covered?

1. Participating gas companies definitely established a clear-cut definition of the purposes of the campaign in the resolution passed at the convention in Chicago last October, and instructions of Major Strickler's committee to the advertising agency definitely set the aim as the creation of public acceptance for gas. The cooking load was unanimously accepted as the key to the situation—in spite of the wide sectional variation in the problems confronting participating companies.

2. Three years was set as the initial period for the campaign, which shows an understanding of the time necessary to fulfill its purpose.

3. Able leadership has been clearly indicated by the progress made by each committee.

4. The continuing driving force after the first appearance of success—that is up to gas companies participating in the campaign. If this campaign is going to continue to ring the bell, gas men will have to continue to *work* to capitalize every feature of the campaign locally, among their consumers, among their employees, right down to the appliances on the sales room floor.

5. Is there adequate tie-up material to bring all the participating companies and dealers into full co-ordination with the campaign? A portfolio recently sent to all sharing in the campaign showed that material in detail. A study of it will show that it can be used and that it will work for you.

This campaign is designed to put gas in the front rank where it belongs. The machinery for doing so is now in actual operation. But the Association must have the co-operation—the enthusiastic co-operation, not merely dignified acquiescence—of gas companies and dealers. The advertising agency's best efforts and the dollars the companies invest in the campaign will be of little value unless in the American Gas Association there exists the wholehearted participation of every company, every department, every individual that has any interest in promoting the sale of gas.

The one factor most frequently responsible for the failure of co-operative campaigns is lack of co-operation. It is now squarely up to those joining in the gas campaign to provide the local tying-in that will produce results.

A. G. A. To Augment McCarter Award

AWARD of an additional certificate in connection with the McCarter Medal, in recognition of assistance contributing to the successful application of the Schafer prone pressure method of resuscitation, was approved by the executive board of the American Gas Association at its meeting in New York, December 9.

This action was taken on recommendation of the accident prevention committee and with the approval of Thomas N. McCarter, president of the Public Service Electric and Gas Co., Newark, N. J., donor of the McCarter Medals and Certificates. Such a certificate makes possible the recognition of a person who rescues a victim of asphyxiation, but does not participate in the actual resuscitation.

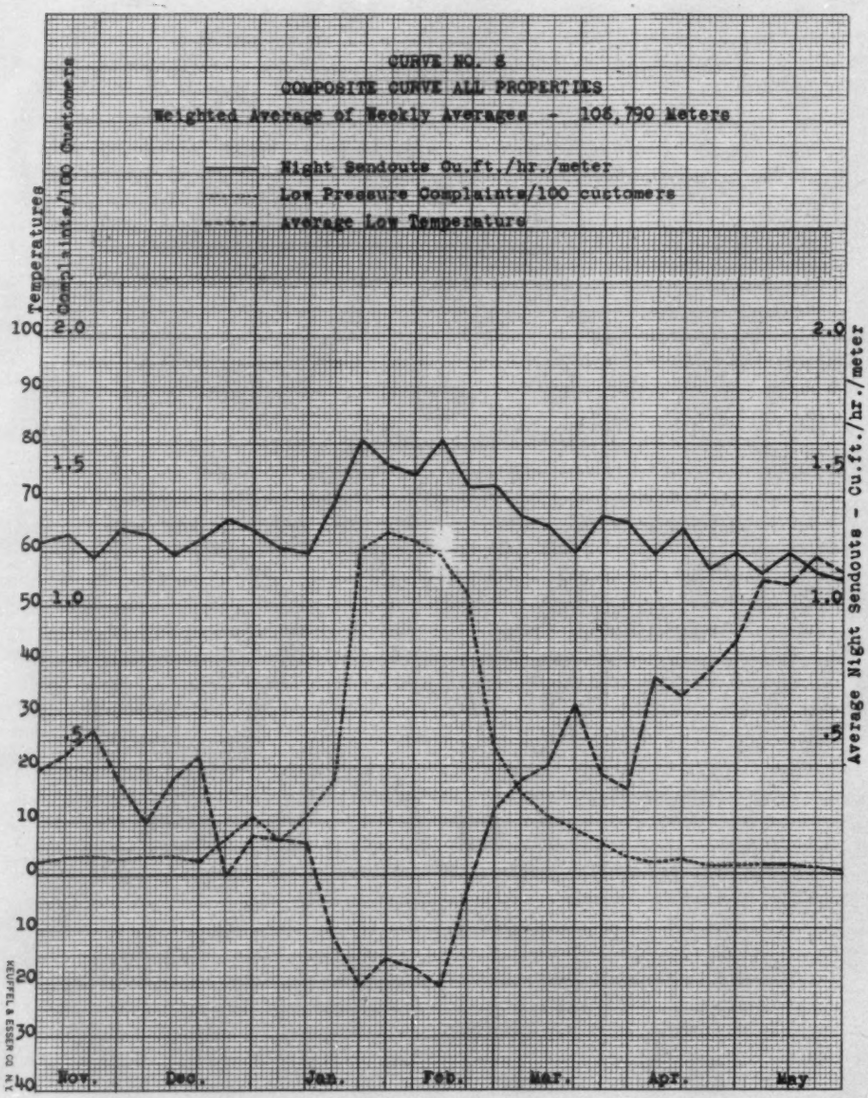
Since the McCarter Medal was first established in 1923, a total of 545 men and women employed by the gas industry have been awarded this medal for saving a life; 28 have received bars for saving a second life; two have saved three lives, and in recognition of repeated bravery, each has received a McCarter Medal and two bars. A total of 227 certificates have been awarded to those assisting in resuscitations by the prone pressure method.

In establishing the McCarter Medal, Mr. McCarter sought to provide suitable recognition for acts of heroism by members of the gas industry and to stimulate interest in and a knowledge of the prone pressure method of resuscitation.

■ ■

Adams Elected Chairman of A.G.A.E.M. Division

Frank H. Adams, Surface Combustion Corp., was elected chairman of the Industrial Gas Equipment Division of the Association of Gas Appliance and Equipment Manufacturers during recent balloting by mail. A. V. Mada, The Gehnrich Corp., was elected vice-chairman, and B. P. Lattner, of the P. M. Lattner Manufacturing Co., was elected to the executive committee.



Composite curve showing night sendouts, low pressure complaints, and average low temperature for 108,790 meters of Northern States Power Co.

Solutions To Some Problems Arising From Winter Gas Troubles

● **A. H. ABBOTT and R. L. RUNDORFF, Northern States Power Co., Minneapolis, Minn.; from a paper entitled "Winter Gas Troubles" delivered to Mid-West Gas School and Conference, Iowa State College, Ames, November, 1936. — (Abstract by GAS).**

THE winter of 1935-36 was the most severe in the history of the Northwest. Not only were abnormally low temperatures experienced, but these low temperatures were of long duration and taxed the facilities of gas companies in this area in rendering service and in keeping their systems in repair.

The Northern States Power Company operates 11 separate gas plants and 15 separate distribution systems in Minnesota, Wisconsin and North Dakota.

Generally, gas troubles during the extreme weather consisted of interference to service due to a large number of frozen services and mains, and also hazards and abnormal sendouts due to breaks in the distribution system. Difficulties in the gas plants consisted mostly of keeping water lines, tar lines and drains thawed out and in operating condition, and making additional gas to replace that lost through abnormal leakage. Extra vigilance was of course needed at the gas plants to keep production going smoothly, although this work proved to be largely routine operation and was quite within the scope of gas plant crews. Troubles in the distribution system, however, were a different matter, and both service freeze-ups and broken mains and services occurred in such numbers that very heroic efforts were needed to cope with the situation.

Normal winter weather prevailed up to January 20, and starting on that date, temperatures dropped far below zero and continued below zero for about six weeks. Every property encountered weather of 30° below zero or colder, Grand Forks experiencing the coldest weather with a reading of 42° below zero. From December 1, to May 31, service freeze-ups totaled 9604, an increase of two and one-quarter times over the average for the three previous corresponding periods, and the number of breaks in the distribution system totaled 491, an increase of two and one-tenth times.

In most plants a record is made of hourly sendouts, and particularly night sendouts are watched for excessive leakage. This can be done quite effectively in the smaller distribution systems, and where there is no house heating load, broken mains and services in distribution systems up to 6,000 or 8,000 meters can be detected in this manner.

Fig. 1 represents the above conditions as a weighted average for all our properties. It will be noted that as the temperature dropped suddenly on January 20, a very sharp increase in frozen services was experienced, and this large number of low pressure complaints continued throughout the cold weather; also that the night sendouts increased quite rapidly when average low temperatures dropped below zero, and followed the inverse of the temperature curve.

There are several conditions which tend to increase night sendouts in the winter as compared to the summer.

Where there is any househeating served, there can be no check on night sendouts since the heating plants are thermostatically controlled, and the amount of gas used for heating during the night hours depends on the severity of the weather. Additional gas will be required for heating water due to lower inlet water temperatures and to cover greater radiation losses in storage water heaters. It is not felt that this increase will be noticed from day to day, or from week to week, but comparing winter to summer night sendouts, undoubtedly a part of any increase is due to this additional water heater load.

Additional leakage occurs in winter due to breaks in the distribution system, and to corroded mains and service pipes which give way due to the greater ground stress caused by lower temperatures and freezing.

There is an apparent increase in winter sendouts as compared to summer sendouts due to loss in volume and

water vapor content of the gas sent out and in storage, because of low temperatures in the distribution system.

If temperatures at which gas is metered on the consumers' premises are above 30°, there will be an increase in the volume of gas when drawn from the distribution system and metered. This latter condition will tend to offset the shrinkage in volume due to loss in temperature. A system might show an increase in hourly night sendouts due to extremely cold weather of approximately 10 per cent without reflecting any increased leakage or use. If night sendouts suddenly increase to much over 10 per cent, it is quite likely that some leaks are developing.

It is quite common for the ground to crack during extremely cold temperatures and these cracks very often break the main or loosen the service, and most of the breaks have occurred in the threaded portion of the pipe just at the couplings. It is imperative to find these leaks immediately, and particularly before any further snow covers up the ground cracks.

Patrolling of all the streets is immediately started to locate cracks in the ground or in the packed snow, and all of these cracks are checked for gas. It is found that the gas comes up out of the ground crack and does not as a rule extend out into the ground and enter basements to cause leak complaints; also that gas coming out of the ground cracks has a tendency to slightly discolor the snow right at the crack so that bad leaks can be found in this manner.

Attempted remedial measures to eliminate service freeze-ups include vaporization of alcohol into the gas, in quantities as high as 100 gallons per 1000 cubic feet of gas. This gave sufficient promise to warrant further investigation. Another expedient was to install outdoor coolers to cool the gas and extract moisture. This latter showed considerable effectiveness, and it is felt that dehydration of the gas is the most tangible and practicable procedure.

Commercial Cooking Appliances Offer Profitable Field For Gas

● **W. FRANK ROBERTS, Standard Gas Equipment Corp., Baltimore, Md., addressing Industrial Gas Section, American Gas Association Annual Convention, Atlantic City, N. J., October 26-30, 1936; topic, "What the Gas Industry Now Has to Offer in Commercial Cooking Appliances."—(Abstract by G A S.)**

COMMERCIAL cooking is a desirable load for any utility and for any industry selling bulk fuel. The sale of equipment in this field is attractive business for manufacturers, because its volume is large and steady, and there are many opportunities to incorporate new ideas to the profit of those who advance and skillfully apply them. This situation is the basis of competition and therefore those who have the business must always defend it. Those who want the business can be depended upon to work hard to get it.

W. FRANK ROBERTS

In the past the industry worked hard to get this business from coal, when coal was the medium that cooked practically everything in public eating places. For a long while one coal range was replaced with one gas range, two coal ranges with two gas ranges and so on. But even that far back a technique of specialized cooking was gradually being developed; for instance, coffee was being cooked in urns instead of in large kettles; and steam tables made their appearance. Then there were griddles and other special cooking apparatus. Finally it was realized that the range was no longer the universal cooking appliance it had once been. Particularly in recent years, the primary functions of the range have been split so that there are now in the kitchen space once occupied by ranges only, a string of diversified appliances that includes broilers, roasters, deep fat fryers, open tops, etc., in addition to a limited number of sections of ranges.

It can safely be said that improvements in commercial cooking appliances have advanced more in the past four years than in the previous twenty years. These improvements include finer appearance, better workmanship, more compact construction, greater efficiency and less labor to operate. Finally, it is easier for service men to maintain and keep this equipment in efficient and effective operation.

From the user's standpoint, the appliances are simpler to operate, greater speed is possible in all cooking operations, and less fuel is required to do a given amount of cooking. Insulated ovens, thermostatically controlled, mean considerable saving in gas, and more uniformity in the character of the food cooked; also less waste by food spoiled, due to being overcooked, or actually burned up through neglect or inattention on the part of the chef.

Aside from the fact that 20 to 50 per cent saving in fuel can be attained through the insulated-controlled ranges, it is possible to prevent shrinkage losses in roasting meats and fowl by roasting at lower temperatures in heat controlled ovens. The savings in meat shrinkage in many hotels, restaurants and hospitals, would pay for the new up-to-date equipment in 6 to 12 months.

The development of the ceramic broiler is something not to be overlooked. There are several types of construction and care must be exercised in selecting the one which produces the greatest heat and at the same time uses a minimum of gas. As in all appliances, proper ventilation and combustion is necessary.

Considerable difficulty has been caused by trying to use improperly designed ceramics. It is not a question of ceramics only, but the burner construction, venting, circulation and other features have to be considered to get the required and best results. The ceramic broiler will turn out the best broiled foods that it is possible to produce, because of the intense penetrating radiant heat.

Another appliance that in the past two or three years has been meeting with considerable favor, is the automatically controlled deep fat fryer. Considerable time has been spent in development and research to bring out a better fryer. Many troubles had to be overcome, such as high operating cost for gas and frying grease, upkeep, poor thermostats, too rapid burning out of grease pot or kettle, pitting of pot due to chemical action.

Manufacturers have developed and are now producing cooking tops on commercial ranges that will meet the needs of any and every cooking requirement. Among these are hot-top ranges, with and without top thermostatic temperature control. Spacious open-top and fry-top ranges and ranges with combinations of hot-top, open-top and fry-top. These combinations can be arranged so as to meet the whims and fancies of any chef.

Those interested in building up their gas load and holding it should familiarize themselves with all these new features and have specially trained men out in the field advertising and advocating the use of modern equipment. Trained men are necessary, as others can do more damage than good.

The sooner replacement is made of

the antiquated types of commercial cooking equipment for the new, the sooner the advance of competitive fuels will be stopped.

The food purveyors are not asleep. They are creating forces that must be taken into consideration by both gas utilities and manufacturers, when planning steps to hold and increase this business. They are, at great expense, revamping and modernizing their places of business. They are training their personnel to do a better job with the cooking appliances they buy. They are studying food and studying menu building as never before. They are advertising and making a better appeal in general to the public. And because of the competition they face, they are doing everything they can to keep costs down.

■ ■

Vice Presidents Honored in B. C. Electric Sales Drive

SUCCESS of the Vice-presidents' Sales Campaign held recently by the British Columbia Electric Railway Co., Vancouver, B. C., has prompted the company to make this sales effort an annual event, according to word from W. C. Mainwaring, general sales manager of the company. The campaign, which enlisted the cooperation of all company employees, honored Vice-presidents E. H. Adams and A. T. Goward. A month's campaign of a similar nature, honoring W. G. Murrin, president of the company, is regularly scheduled for May.

During the Vice-presidents' campaign, which ran from September 21 to October 3, over 400 prospects were received from employees other than those employed in the Merchandise department. Sales quotas for the company's territories were set at $42,500.00. Total sales during the campaign amounted to $53,021.98. Approximately 25 per cent of these figures apply to the sale of gas appliances.

Throughout the year sales prospects are developed through the employee cooperative prospect plan, prospects derived from this source averaging 5,000 per year. Employees other than those in the sales department are given bonuses ranging from $5.00 for the sale of a central heating plant to 50 cents for the sale of a hotplate. The two sales campaigns honoring the president and the vice-presidents, scheduled six months apart, have proved a definite stimulation to the company's employee sales activities, according to Mr. Mainwaring.

■ ■

Standard Oil Well Indicates New California Gas Field

A Standard Oil Co. wildcat well coming in at an estimated 2700 barrels of 37° gravity oil per day, and 2,700,000 cubic feet of gas, indicates the opening of an entirely new oil field in Kern County, Calif.

The new well is located near Rosedale, ten miles west of Bakersfield, on property of the Kern County Land Co. The area, on which the Standard Oil Co. has several thousand acres of leased land, will be known as the Greeley Field.

Welding in Constructing, Operating, and Maintaining Pipe Lines

● **T. R. JONES, T. R. Jones, Inc., Dallas, Texas, presenting in Part I portions of a paper, "Progress in Pipe Line Welding." R. P. GONZALES, assistant superintendent, pipeline division, Arkansas Louisiana Gas Co., presenting in Part II, portions of a paper, "Oxy-acetylene Welding in the Operation and Maintenance of Pipe Lines." Both papers were delivered before the 37th Annual Convention, International Acetylene Association, St. Louis, Mo., November 18-20, 1936.—(Abstracts by GAS).**

PART I

THERE appears to be a definite trend today relative to joint design for welding, and the type of pipe material used for overland lines. Oxy-acetylene welding has always favored the open butt joint design from the standpoint of simplicity, low costs, and high overall joint efficiency. Bell and spigot pipe was used on a few lines some years ago but was discarded in favor of the double bell and inner liner. Double bell pipe has still been retained in a few instances, either because of the desire on the part of operating engineers to use arc welding—which has required the inner liner or chill ring for backing up purposes—or because of the viewpoint of some oil company engineers who felt that this design increased the overall joint efficiency.

The welding fraternity is pretty well agreed, as a result of thoroughly exhaustive tests, that maximum joint efficiency is obtained from the single vee butt weld. Nevertheless, it has become substantially a standard practice to require the use of chill ring liners with plain end pipe in sizes 16 inches and larger.

Possibly some confusion exists as to the necessity for chill ring liners in these big diameter gas lines. Whether the welding process is electric or gas, there is a joint design pertinent to each process whereby that particular process can be applied most economically or most efficiently. It so happens that arc welding costs can be considerably decreased through the use of a backing-up strip or chill ring liner. The insistence upon this liner for use in conjunction with oxy-acetylene welding, however, amounts to the same thing as putting a penalty on gas welding. This is not the joint design which is most acceptable and most economical for gas welding.

The last few years have witnessed some interesting developments in pipe materials and pipe fabrication. Practically all new pipe is today specified as Class B. This material has a nominal tensile strength of 60,000 pounds per square inch minimum—actually the tensile will be closer to 72,000 pounds per square inch. Lap-welded pipe has practically disappeared and in its place is either seamless or electric welded pipe. Apparently much better attention is being given by the mills to their fabricating methods, since pipe ends are more accurately sized than formerly and but very little trouble is experienced now-a-days with egg shaped ends.

The higher strength material has led to the substitution of lighter wall pipe for equivalent operating conditions. Part of this trend toward lighter wall is due to these improved physical characteristics and part to a more scientific attitude toward soil corrosion. Coating materials have been considerably improved upon, and some companies have gone so far as to make soil surveys along the right-of-way to determine scientifically to what extent wrapping or coating shall be used. In all likelihood some consideration will be given in the near future to the use of Class C material having still higher physical properties. If and when this material, having actual ultimate strength in the neighborhood of 85,000 to 90,000 pounds per square inch becomes a reality, there may be welding problems to overcome so that the joint may be as strong as, or stronger than the metal being joined.

There has always been a difference of opinion among contractors on one hand, and the oil or gas industry on the other, as to how far they should go in the employment of solid welded construction. Practically everyone concerned is in agreement that pipe sizes up to and including 12 inches can be laid solid welded without any concern for contraction stresses, but for large diameter pipe the argument is that composite construction must be used. This does not seem logical, as it is just as easy a matter to put slack in a 16- or 24-inch line, as in a 6- or 8-inch line if the ditch is excavated wide and deep enough.

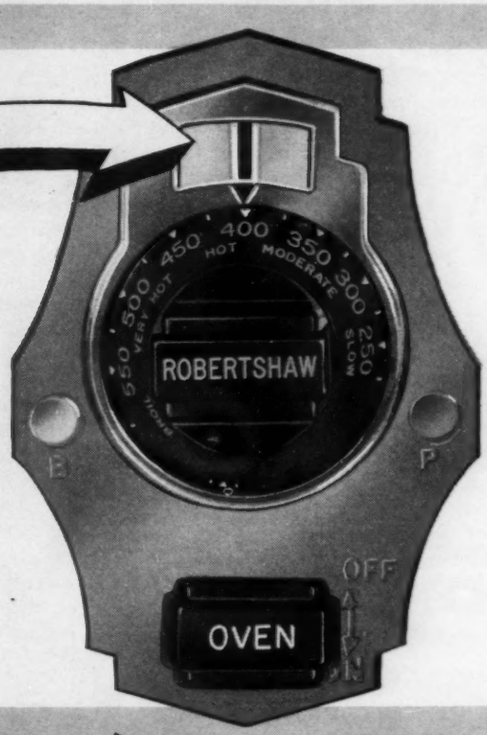
There have been some field experiments going on for the past two years in the laying of spiral weld pipe, which may have considerable influence on this question of "whether to weld or whether to couple." This pipe has an upstanding ridge where the spiral weld is made, and there is a certain amount of flexibility to withstand expansion or contraction due to this method of fabrication. Several short lines, up to several miles long, have been laid in 24-inch pipe, which has been solidly welded together and placed in the ditch without any attempt whatsoever of putting compression

For Gas Ranges!

to the famous Robertshaw oven-heat-control has been added Thermal Eye

Sight!

When the oven reaches the temperature set by the dial a RED SIGNAL comes into view—showing the user that the oven is ready for use!



Action!

Selling action! That's what the Robertshaw Thermal Eye supplies. It catches the eyes of prospects. It increases their interest in your gas range. It gives the salesman something he can talk about—and dramatize!

Thermal Eye stands as the biggest thing that's ever happened in oven-heat control. Its selling influence is important to you. Write Robertshaw for Thermal Eye folder.

FRONT-OF-RANGE ADJUSTMENT—An improvement that saves service hours! Oven by-pass and safety pilot are easily adjusted with a screw driver (at points B and P in illustration above).

ROBERTSHAW THERMOSTAT COMPANY, Youngwood, Pa.

Over 2,700,000 Robertshaw controls are in use

on the line. This sort of pipe develops an excellent ground friction due to the upstanding seams and practically no movement of the pipe can take place after the ditch has been back-filled. These tests have been carried practically to the point where all concerned are convinced of the feasibility of laying lines of any length by this method.

PART II

THE operation of gathering lines in a natural gas system includes a good deal of small pipeline construction, it being necessary to add connections to new gas wells continuously in order to replace the gas supply lost by depleted wells. The operations of a gathering line crew are therefore those of maintenance, construction, and salvage of old lines, and the organization of this crew must include a qualified welder for layouts, connection and the fabrication of drips, separators and special fittings.

Main line maintenance crews must be prepared for an emergency at any time during the day or night, and a complete oxy-acetylene welding and cutting outfit is a standard part of their equipment. During periods of extreme cold weather and peak delivery on a natural gas system, it is customary to hold the maintenance crews at their stations so they may be reached quickly for direction to any case of trouble. Work is provided for the maintenance crews at these stations, while they would otherwise be idle, by employing them in the cleaning and reconditioning of salvaged pipe and fittings. Since the welder in the crew would be otherwise unemployed, it is found profitable to cut out short usable sections of damaged pipe and weld these sections into joints of standard length. Employing a pipe beveling machine and an economical welding method, it is often found profitable to a pipe line company to salvage and return to usefulness by welding into standard lengths short pieces of pipe (commonly called pup joints) no longer than thirty inches.

On a replacement job, the section of line to be replaced is uncovered in readiness for removal. A section of pipe to be used in replacement is welded up at the side of the open ditch. When all is in readiness, the main line section between gate valves where the replacement is to be made is isolated by closing main line valves, the section of line drained, the section cut at each end and raised out of the ditch, the new section lowered into the place of the old pipe and connected by welding.

The pipe removed from replaced sections is hauled to storage points where it is reconditioned for further use. Pipe removed from screw lines or coupled lines can be prepared for use in welded lines by preparation of the ends with a pipe beveling machine. In most cases, better than three-fourths of the pipe removed from badly corroded sections can be reconditioned by welding of corroded pits, cutting out of completely damaged parts and welding into standard lengths.

On salvage work, pipe beveling machine operators are usually selected from the men who have become familiar with the preparation of pipe ends for welding. Such operators can average ten cuts per hour on 16-inch pipe on the reconditioning rack, and have made as many as twenty cuts per hour for extended periods on preparation of salvaged 10-inch screw pipe.

Detroit Writes Finis To Gas Project

(Continued from Page 12)

The small number of complaints relatively indicate that the adjustment job has been especially well done. In scattered cases, however, there seems to have been a slight tendency to leave appliances adjusted somewhat under capacity. If the previous habit of use, especially in cooking, had been for rather an excessive flame, the cook would find a slowing up of her cooking time, and often this was accepted without complaint, the consumer believing that the gas had "less heating power". The company stood ready to make any number of additional adjustments in cases of this kind and where notice was given, the capacities were quickly restored to the desired rate, but there will probably, for a long time, be people who think that the new gas "hasn't much heat".

In one small class of cases only did unforeseen difficulties of moment arise, and it is well for anyone concerned with such a program to have the advantage of the experience of Detroit. That difficulty arose from the use of gas-fired pilot lights for oil burning house-heating furnaces. Among 500,000 consumers' premises, less than 1½ per cent were equipped with such furnaces, yet these pilot lights gave rise to roughly two-thirds of all complaints that arose in connection with the change. This problem was realized rather late in the program and the readjustment of these pilot lights was put in charge of an "oil heat" committee, representing oil companies and oil burner manufacturers who assumed under contract, that oil burner pilots would be properly adjusted. While late in getting organized and making plans, this committee did strenuous service and handled some 7,000 pilot lights, but the difference in burning characteristics of the new gas, led, in the main, to adjustment with a higher burning rate, to maintain a safe pilot flame, than had been necessary with the manufactured gas.

The new rate schedule in Detroit is on the thermal basis, and for this pilot service, which is for ignition only, the extra heating value of the gas was of no importance, but on thermal rate and with the higher adjustment, the cost of the gas had an important effect, not only on the consumer's bill but on his temperament and disposition. In many cases, the first adjustments were at an unnecessarily higher rate of firing. Gradually, the fever is subsiding in this sector. The most difficult cases have either gone to electric ignition or to gas heating installations, and in the other cases, adjustments have been gradually refined, but it is worthy of note for all future "change-overs" that special advanced attention and planning should be given to the question of gas-fired pilots for house heating oil burners.

Sales Results

The acceptance of natural gas service by consumers desiring additional service has been more than gratifying. With adjustments completed only about five weeks, there are more than 6,000 consumers using gas-fired furnaces for house heating. Additional sales are being added rapidly. The increase of industrial use has proceeded to the point where an early notice was given to the pipe line company to be prepared for a 25 per cent larger peak load the first winter than the original estimates.

It is now apparent that the entire available capacity of the pipe line will not supply, by a very wide margin, the potential market when fully developed. Industrial sales are now being accepted conservatively to avoid any risk of overselling. This propitious acceptance of the natural gas service cannot fail to work out a progressive reduction in the net rate for gas to the domestic consumers.

It is fair to say that natural gas has arrived at Detroit under conditions that reflect a great credit to the entire organization of those concerned with the physical problem of introducing a new and different fuel into the half million homes supplied by this service.

■ ■

Complete Line to Severy, Kans.

Stryker Gas Co., Fredonia, Kans., has laid a pipe line to bring gas from the wells north of Severy, Kansas, to the city limits. The city has not previously been served with gas.

Again NORGE LEADS

SEE the Difference—

SELL the Difference—

POCKET the Difference!

The sensational New 1937 Norge Concentrator Gas Ranges are out in front with Pace-Setting Vital Values

EVERY YEAR Norge products are improved—not only to keep them thoroughly modern, but to keep them ahead of the rest in pace-setting features, advanced construction, greater dollar-for-dollar value.

Behind the natural sales appeal of every Norge product is an advertising and sales promotion program that is the envy of the industry—and its strength is increased year by year—its effectiveness multiplied.

Is it any wonder that Norge sets new sales records year after year—that Norge dealers, following the Norge plan, make handsome profits? Get acquainted with the Norge distributor in your territory now. Let him explain the generous proposition he has to offer in the new 1937 Norge Concentrator Gas Ranges. 1937 is going to be another big year for Norge—now is the time to join the Norge profit parade. Liberal finance plans make it *easy* to be a Norge dealer.

NORGE DIVISION *Borg-Warner Corporation,* Detroit, Mich.

NOW! Improved Concentrator Burners on the 1937 Norge Gas Range

• The famous Norge Concentrator Burner has been called the greatest single improvement in gas ranges since the first insulated oven. Now this burner has been further improved. Once a prospect sees it she will insist on having it on her new range—and only Norge Ranges have it.

Another Norge Vital Value that Sells Itself!

GR-1

ROLLATOR REFRIGERATION (DOMESTIC AND COMMERCIAL)
•
GAS AND ELECTRIC RANGES
•
WASHERS AND IRONERS
•
WHIRLATOR OIL BURNERS

NORGE
Concentrator Gas Range

GAS BURNERS
•
FINE-AIR FURNACES
•
COAL STOKERS
•
AIR CONDITIONING
•
CIRCULATOR ROOM HEATERS

Milwaukee Gas Light Co. inaugurated its recently concluded Old Stove Roundup with a sales breakfast. H. J. Dropp, sales manager (center of speakers' table), presided.

Milwaukee Gas Light Closes Fourth Annual Old Stove Roundup

THE Milwaukee Gas Light Co. completed its fourth annual Old Stove Roundup on November 1. During this sales campaign, the company offered its standard 10 per cent allowance for each old gas stove turned in to the gas company, plus a special $5.00 allowance. The cooperating dealers made the same offer. Five free ranges were also given away together with 35 cash allowances for the 40 oldest gas stoves entered. Where the sale was made through the dealer, the gas company purchased the old range entered in the contest from the dealer for a flat price of $2.50.

All gas range dealers were invited to participate in the campaign. Special promotional material went out to them along with entry blanks. The names of dealers returning signed entry blanks to the gas company prior to a stipulated date were listed in the opening advertisements.

The advertising program consisted of a large announcement in the daily papers and neighborhood and suburban papers. This was followed by a continuous campaign throughout the contest. The story of the roundup was also told from billboards.

A tabloid newspaper, describing the campaign and selling the idea of modern gas appliances, was delivered to the home of every gas user served either by Milwaukee Gas Light or associated companies. Distribution of the tabloid took place currently with other announcements.

Point-of-sale cards were displayed by all co-operating dealers. Flyers were also made available to all dealers with the dealer's name imprinted, if desired.

Bonuses were paid for combination sales. Employees also earned a bonus for prospects turned in when the prospects developed into sales. A broncho-busting contest was featured for salesmen, with prizes being awarded to those making their sales quotas. A 7 A.M. banquet was staged for the salesmen on the opening day of the campaign.

Plan Capital Consolidation of Chicago Utilities

THE Boards of Directors of Commonwealth Edison, Commonwealth Subsidiary Corp., Public Service Co. of Northern Illinois, Western United Gas and Electric Co. and Illinois Northern Utilities Co., all of which supply utility services in the Chicago metropolitan area, have announced plans for simplifying and coordinating the consolidated capital structures of the group of companies under the Commonwealth Edison Co.

The consolidation, according to James Simpson, chairman of the board of the Public Service Co. and the Commonwealth Edison Co., "would improve individual company credit positions and facilitate future financing at low interest rates to cover necessary expansion." Such advantages, he said, should be of mutual interest to the companies, stockholders and the public.

A special meeting of the stockholders of the Edison Co. has been called for January 23rd to vote authority for the board to proceed according to its best judgment. The plan is subject to the approval of the stockholders of the company and of the Illinois Commerce Commission and to the appropriate proceedings before the Securities and Exchange Commission at Washington, D. C.

■ ■

Change-over to Natural Gas Completed in Moline Area

THE final district in Moline and East Moline, Ill., has been changed over to natural gas, according to an announcement issued last month by R. B. MacDonald, president and general manager of the Peoples Power Co., Moline. Gas is being supplied from the system of the Natural Gas Pipeline Co. of America. The area being served comprises approximately 20,000 meters, and the change-over involved the adjustment of some 50,000 appliances in Rock Island, Moline, East Moline, and Sylvis. A sum of $265,000 was expended by the Peoples Power Co. for labor and materials.

One big job yet remained, according to Mr. MacDonald, that of rechecking the 50,000 appliances to insure their proper operation so that consumers in the area may benefit by the lower rates permitted by the change.

■ ■

Fisher, P. G. and E. Executive Receives McGraw Medal

IN recognition of his efforts to promote industry and dealer co-operation, R. E. Fisher, vice-president in charge of public relations and sales, Pacific Gas and Electric Co., was awarded the James H. McGraw medal for co-operation. The medal was presented December 11, at a banquet at the Fairmont Hotel, San Francisco. Four hundred friends among utility men, manufacturers, and dealers, attended. This is the twelfth medal of its kind to be awarded.

R. E. FISHER

In 1932, Mr. Fisher received the gold medal of the Pacific Coast Gas Association for "the promotion of harmony in trade relations."

■ ■

Death Takes John F. Egolf, Western United Executive

JOHN F. Egolf, since 1927 director and operating vice-president of the Western United Gas & Electric Co., Aurora, Illinois, died of a heart attack on November 22 as he was attending a Thanksgiving Day shoot. He was widely known in Middle West utility circles, having served as general manager of the Aurora, Elgin & Chicago Electric Co., the Chicago, North Shore and Milwaukee Railroad, and the Chicago, Aurora & Elgin Railway.

In 1928 Mr. Egolf instituted the Employe Prospect Plan for Western United Gas & Electric Co. The plan prospered for four years, and in 1928 Mr. Egolf started the President's Million Point Club, which was completing its fifth year of successful operation at the time of his death.

■ ■

Community Natural Changes Announced by Denning, Jr.

L. B. Denning, Jr., recently named vice-president and operating manager of Community Natural Gas Co., has announced the following changes in personnel:

John W. Inman, former sub-district manager at Honey Grove, has been transferred as district manager to Sulphur Springs, succeeding A. V. Tomlin, who has left the service of the company. A. D. Barnett, outside foreman at Bonham, succeeds Mr. Inman as sub-district manager at Honey Grove.

Fay Bridges, former sub-district manager at Teague, has been transferred to the Handley meter shop. He is succeeded by D. L. Kitchen, formerly of Mexia.

From Tanks of NON-RUST EVERDUR METAL

THE PUBLIC GETS: Clean, rust-free hot water indefinitely . . . Complete freedom from rust expense . . . Longer service and better value

THE UTILITY GETS: Steadier gas consumption . . . Freedom from constant servicing . . . More satisfied customers

EVERDUR METAL *cannot* rust. And this explains why tanks of this strong copper-silicon alloy are more satisfactory not only to the public . . . but to the utility as well.

For the buyer . . . an Everdur tank provides the assurance of clean, *rust-free* hot water indefinitely. It marks the end of all tank repair and replacement costs due to rust.

From the standpoint of the utility . . . Everdur tanks are profit-makers. Rust and rust-repairs never interfere with the steady consumption of gas. Everdur tanks require far less servicing. They may be sold with complete assurance that their reliable performance will satisfy customers. They can be guaranteed against tank failure through corrosion. They provide a sound basis for longer-term payment plans.

Because it is absolutely immune to rust, durable, easily welded and strong-as-steel . . . no less than 24 leading manufacturers of automatic gas storage water heaters now standardize on Everdur Tanks for rust-proof models. 36123

EVERDUR METAL
"Everdur" is a registered trade-mark, identifying products of The American Brass Company made from alloys of copper, silicon and other elements.

THE AMERICAN BRASS CO.
General Offices: Waterbury, Conn.
Offices and Agencies in Principal Cities
In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

EVERDUR METAL FOR TANKS

RUSTLESS AS COPPER . . . STRONG AS STEEL

Restaurant gas cooking and other gas appliances shown at the regional convention of the National Restaurant Association in Washington, D. C.

Heavy Duty Kitchen Equipment Shown To National Restaurant Association

PROMINENT at the regional convention of the National Restaurant Association, held in America's famous Mayflower Hotel in Washington, D. C., December 7-9, was the display of heavy duty gas cooking equipment. Sponsored jointly by the Washington Gas Light Co. and the Industrial Gas Section of the American Gas Association and a group of manufacturers, this gas display occupied 56 feet of the Mayflower's main lobby.

Featuring the latest developments in gas ranges and other diversified gas appliances for restaurants, the display included the recently developed top and bottom controlled deck bake ovens, deep fat fryers of improved design, several sections of heavy duty gas ranges, a 10 cubic foot gas refrigerator, automatic gas space and water heaters. Along the wall was a 50-foot sign reading, "Gas is Best for Cooking, Refrigeration, Water Heating and Space Heating."

Although this was a regional affair, the attendance was around the 2000 mark and was drawn from twelve states. The gas exhibit, manned by representatives from the Washington Gas Light Co. and from manufacturers, was by no means the only display of gas equipment. Many of the other exhibitors showed various gas operated gadgets such as gas coffee brewing sets, improved gas coffee urns, the new automatic gas toasters, etc.

The gas exhibit was under the supervision of Henry M. Brundage, Jr., general sales manager of the Washington company. The Association's co-operation was through the committee on national industrial displays of which Harry A. Sutton is chairman.

Order Retrial on Lone Star Condemnation Case

HOLDING that the trial court should have granted Lone Star Gas Co., Fort Worth, Texas, an injunction against the city of Fort Worth, which is seeking to condemn the company's property and take over the gas distribution system, the Texas Supreme Court has ordered the case returned to the lower court for retrial. Lone Star brought suit against the city after the city had instituted condemnation proceedings.

The company, according to views expressed in the Blue Blaze News, in reviewing the case, has contended there were no adequate and appropriate provisions in either the general state statutes or the charter of the city prescribing method of procedure and the manner of condemning property of the kind.

The Supreme Court's opinion stated that there is no procedure set up by general law for ascertaining the just compensation to be paid plaintiff for its property in case of condemnation and no sufficient provisions made for taking possession of the property before a final adjudication of the question of compensation, and that it is evident that there must be further legislative action providing adequate and appropriate procedure for condemning properties of the kind involved in the case.

The Supreme Court held that the trial court erred when it refused to grant an injunction by sustaining the city's general demurrer, a decision which the Court of Civil Appeals had upheld.

■ ■

Humble Oil Plans 122-Mile Texas Gas Line

ANNOUNCEMENT of plans of the construction of a 122-mile, welded, 10-inch gas line from the Tomball field in Harris Co., Texas, has been made by the Humble Oil and Refining Co., of Houston. The line is to serve industrial areas at Houston, Port Arthur, Baytown, Beaumont City, and Port Neches. With a capacity of 60,000,000 feet daily, the line is expected to be in operation by April 1.

Industrial consumers in these cities have already contracted for the gas, and the line will later include the Dickinson, Anahuac and Amelia fields, in which large proven gas reserves are owned by the Humble Oil and Refining Co.

This is the company's third venture into the industrial gas field. Recently a gas system for the city of Tomball was constructed, and from the Pledger field in Brazoria County the company operates nearly 37 miles of gas lines to the Long Point, Old Gulf, and Boiling Sulphur fields, where it is furnishing gas to the Texas Gulf Sulphur Co.

■ ■

P. G. and E. Outlines 1937 Sales Program

AFTER a record-smashing year in appliance sales by the retail dealers throughout its territory, the Pacific Gas and Electric Co. is planning expansion in its co-operative sales plans for 1937, according to H. M. Crawford, general sales manager of the company. In this connection, it is of interest to note that for the first 11 months of 1936 only 3 per cent of the major appliances sold in P. G. and E. teritory were sold by the company itself. The company will continue its policy of selling only a few of the major load-building appliances.

H. M. CRAWFORD

Improvement of the economic conditions throughout northern California, coupled with increased purchasing power, have convinced the company, according to Mr. Crawford, that there should be no slacking up of appliance sales stimulation. Augmented promotional effort, from the company's viewpoint, is made doubly important in the appliance field, due to the $6,500,000 rate cuts made to its customers during 1936 and the additional $3,000,000 rate cut already announced to take effect shortly after the first of next year.

During 1937 the company will stimulate dealer sales by furnishing leadership in the promotion of industry campaigns, utilizing all its advertising in some 300 newspapers, billboards, direct mail, window and floor displays, and its own sales organization to assist the general promotion of appliance sales.

Vigorous support of gas and electric appliance societies' campaigns will be continued. Several campaigns have already been planned by the societies for next year. In discussing the company's plans for 1937, Mr. Crawford stated that he was gratified with the appliance sales results obtained in the several campaigns conducted by the societies during 1936, and that he is looking for a rally among business men in both the gas and electric appliance fields during 1937. Company quotas, which include the entire industry, have been set considerably above the record accomplishments of 1936.

■ ■

Bring in Oklahoma Gasser

Test recently of the Gailey wildcat well in Southern Texas County, Okla., showed that gas pay was topped at 2,661 in brown dolomite, and continued to increase in volume as drilling progressed. Colume was estimated at from 2,000,000 to 3,000,000 cubic feet.

Gas was topped 51 feet higher in the Gailey test than in the Three Way well in the same area.

Madam, be sure your appliance will keep that "Sales-Floor Complexion"

DURABILITY PORCELAIN ENAMEL Fused on Metal

● "Many women are becoming very discriminating about the finish of their household appliances. They see lovely things on the sales-floor—but they are more and more saying: Yes, it's pretty—but how long will it stay that way?

"And, Madam, the answer to that question is: If it is porcelain enamel—it will stay that way—*always*... Because porcelain enamel is a glass-like, flint-hard, mineral substance that never fades or loses its lustre; never scratches or mars under ordinary household usage. It is the one finish that will keep its 'sales-floor complexion'—for a lifetime.

"Porcelain enamel is the finest quality finish you can buy. That is why we urge you to buy it. We know it will prove entirely satisfactory and, quite selfishly, we want satisfied customers. Choose this porcelain enameled appliance, Madam. It is the lifetime finish."

AT THE NATIONAL HOUSE FURNISHINGS SHOW
January 10-16—it's the
STEVENS HOTEL—ROOM 820-A

EDUCATIONAL BUREAU
PORCELAIN ENAMEL INSTITUTE, Inc.
612 North Michigan Avenue • Chicago

PORCELAIN ENAMEL *THE Lifetime Finish*

Brides learn how to use modern gas appliances in the classes held in the all-gas kitchen of the "Bride's School"

Busy Brides Bake Better Biscuits

AN all-gas kitchen is the laboratory of "The Bride's School," a three months' course of instruction offered by Scientific Housekeeping, Inc., New York City, to teach brides-to-be and young matrons how to manage their households smoothly. Popular with the younger set of New York's "social register" group, the novel school just recently celebrated its first anniversary.

In the attractive kitchen where the "brides" learn secrets of palate-appeal, modern equipment including a gas-operated Servel Electrolux refrigerator, a modern gas range, compact storage cabinets, smooth table tops are used. At the same time, the students learn the importance of efficient gas equipment. Meals prepared by students are served, in an attractive dining room and arranged by another group of "bridal" students.

The school offers a practical course for young women unfamiliar with making market lists, planning menus, buying household equipment and caring for it after it is bought, budgeting, and overseeing the infinite details of entertaining. Practical experience in home management is offered under individual instruction, the classes never exceeding more than 12 in number. It is intended that the students know the fundamentals of every type of activity concerned with household management before they complete the course.

Paul D. Warren Retires From Chicago Co. Sales Post

PAUL D. WARREN, who created the first home service department in the gas industry and under whose direction was started the first radio broadcasting of meal planning and serving in the world, retired on January 1 from active duties as assistant to the vice-president in charge of sales of The Peoples Gas Light and Coke Co., Chicago. He had been with the company for 41 years, and had been assistant to the vice-president since 1924.

PAUL D. WARREN

Mr. Warren entered the bookkeeping department of the Chicago utility after a few years of training in various branches of the company's work. He first proposed installation of the addressograph system. Prior to his position as assistant to the vice-president, Mr. Warren had been successively manager of the addressograph department; head of the stationery department; assistant to the superintendent, and later superintendent, of the application (now customers' order) department.

His pioneering work with the home service department has won for Mr. Warren wide recognition. Since its development by the Chicago company, such departments have been opened not only by hundreds of other gas companies, but by newspapers and magazines.

Mr. Warren was president of the Illinois Gas Association in 1927 and 1928. He has served as chairman of numerous committees in the accounting and commercial sections of the American Gas Association, and for three years was in charge of the accounting section exhibits in the conventions at Atlantic City. He was also vice-chairman and chairman of the Association's home service committee.

■ ■

Scholl Named Texas Cities Corsicana Division Head

Leon M. Scholl, superintendent of distribution for the El Paso plant of Texas Cities Gas Co., has been appointed division superintendent for Corsicana division of Community Natural Gas Co., according to announcement by L. B. Denning, Jr., vice president and operating manager of the company. Mr. Scholl succeeds the late Louie Cole of Corsicana.

B. B. Stringfellow, former district manager for the Community at Cleburne, has been transferred to El Paso to succeed Mr. Scholl. P. E. Warren, formerly in charge of industrial installations and meter shops at El Paso, has succeeded Mr. Stringfellow at Cleburne.

Mr. Scholl has been connected with the gas business in Texas since 1920 when he joined the old Galveston Gas Co., and has worked for the Dallas Gas Co., the old Fort Worth Gas Company, Community Natural and Texas Cities. Prior to his transfer to El Paso in 1935 he was manager of the old Sweetwater division of Community Natural.

■ ■

Annual Natural Gas Meeting To Be In Kansas City, May 10

THE A.G.A. Natural Gas Department's spring meeting will be held in Kansas City, Mo. during the week of May 10, 1937, according to Captain A. E. Higgins, secretary of the Department.

This meeting will be of unusual interest to the natural gas industry as the manufacturers and supply men have decided to hold an official exhibit. This will be held in the new Civic Auditorium which has a total display space of 90,000 square feet. From the preliminary interest shown, this will be the largest and most instructive display of the latest developments by the manufacturers, supply men, and appliance manufacturers.

CAPT. A. E. HIGGINS

The hotels of Kansas City have already been advised of this coming convention. While a guarantee of ample rooms to house delegates has been made, those planning to attend are urged to make reservations as far in advance as possible in order to assure proper accommodations.

The program committees are already at work laying out a program of live and interesting topics for discussion during this gathering and shortly after the first of the year a tentative program of proposed subjects and events will be issued.

■ ■

Chicago Co. Names Deveney Station Superintendent

Walter T. Deveney, who has been with The Peoples Gas Light and Coke Company, Chicago, for 25 years, has been appointed superintendent of 110th Street station. He succeeds Frank W. Thomas who retired on January 1.

Mr. Deveney's work during his quarter-century with the company has been in the operating department, at the plants, in the construction department—where he had charge of field work on the North Shore, 73rd Street and Crawford holders, and the Calumet distribution station.

■ ■

Coast Counties Reduces Rates

Coast Counties Gas & Electric Co., Santa Cruz, Calif., effective December 1, 1936, voluntarily reduced gas rates in its G-5 schedule, covering general service. The reduction to consumers will approximate $30,000 a year. It is the second cut in this schedule during 1936.

WOMEN WANT *the complete cooking freedom of the Automatic Clock!*

WHEN YOU FAIL TO SHOW THE AUTOMATIC CLOCK YOU FAIL TO SERVE CUSTOMERS COMPLETELY

AND what woman *doesn't* want a feature that enables her to put a roast in the oven hours before dinner...set the controls that turn the gas both on and off... go out for a carefree day...and come back to a dinner that's cooked to full-flavored perfection! *That's* what women call *cooking*...and that's what a modern gas range must do to be really *complete*!

When you show your customers the new Wedgewood with the Grayson Cooking Clock... when you explain just how this magic mechanical clock makes cooking a joyous adventure, you take advantage of a *natural selling point*... you take advantage of a feature *women want*!

Model shown:
No. 1045 C-T... Closed Top, Table Top Model
No. 1085 O-T... same as 1045 but with open top

WEDGEWOOD'S AUTOMATIC FEATURES THAT MEAN MORE SALES:

- Automatic top burners that light at the turn of a hand...no matches ...no bother.
- Automatic oven lighting... no stopping to light burner.
- Automatic oven temperature control...maintains low, even, s-l-o-w heat... without attention. Cooks roasts to tender, juicy goodness... no meat shrinkage...no watching. Saves up to 20 per cent of gas.
- Automatic safety lighter on Built-in Gas Circulating Heater... instant, healthful kitchen warmth at the click of a valve. Full porcelain enameled heating unit. (Patent applied for.)

WEDGEWOOD *The Modern Gas Range*

MORE THAN A MILLION SATISFIED USERS

JAMES GRAHAM MANUFACTURING COMPANY · San Francisco · Los Angeles · Newark · Portland

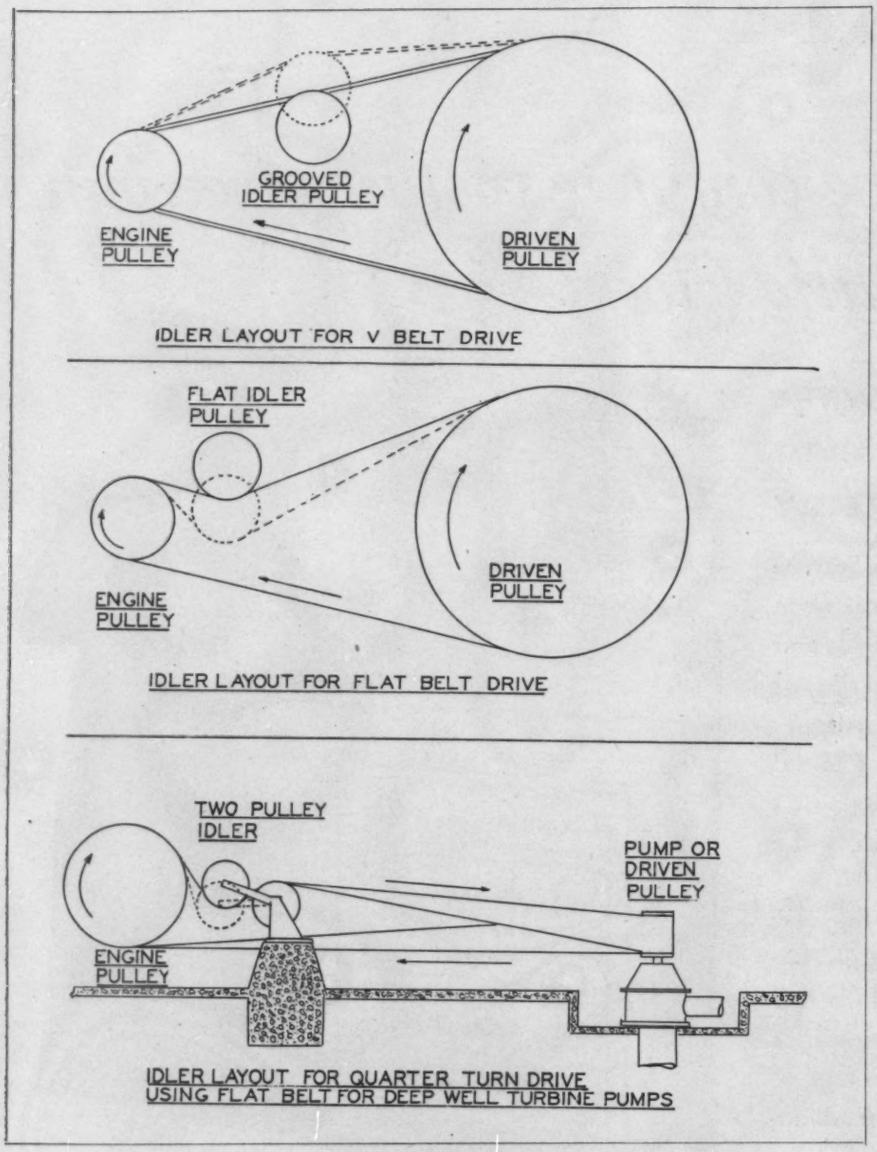


FIG. 2.

Selecting A Natural Gas Engine

(Continued from Page 14)

(4) Intermittent Load, Intermittent Operation, 70 pounds MEP (average) 1000 feet per minute piston speed or over as warranted. (See Tables Nos. 1, 2, and 3).

Due allowances must be made for future or ultimate horsepower requirements.

Since the accessories required by an engine are as important as the engine itself, a few words regarding these may be in order.

Protective Devices: Each gas engine should be provided with dependable automatic devices to shut the engine down in case of cooling water or oil pressure failure.

Starting Equipment: Small engines, 60 horsepower and under, can be started readily with electric starters. When electric starters are used the battery should be kept up with a trickle charger rather than with a generator in the engine. Above 60 horsepower the engines should be started either by compressed air or by a gas engine starter.

Ignition: The very best make of high tension magnetos should be installed. If this is done, dual ignition is not necessary. Small engines using electric starters can use battery ignition.

Gas Mixer: It is our opinion that a venturi type of gas mixer is best suited for the reasons that these have no moving parts, no adjustments except for idling and have the ability to furnish approximately the proper mixture regardless of load or speed if the gas is on a near atmospheric pressure entering the mixer.

Cooling System: It is recommended that a closed cooling system be installed on every engine, this will eliminate trouble due to liming up of the water-jackets in the engine. In small engines sometimes it is more convenient to install a radiator; if so, the radiator should be of ample capacity and caution should be used in the operation of the fan so that the noise from its operation will not be objectionable.

All exhaust manifolds should be water cooled, and it is also desirable to have the exhaust line water cooled to the ground level. A very important factor in the cooling system is a first class cooling water pump.

It is desirable to have thermometers at the intake and discharge of the cooling water to the engine, as it is best to have the difference between the incoming and outgoing water temperature as little as possible.

Exhaust: An unrestricted exhaust is objec-

TABLE NO. 3. ENGINE REVOLUTIONS PER MINUTE RECOMMENDED FOR ENGINES DIRECT CONNECTED TO A. C. ELECTRIC GENERATOR

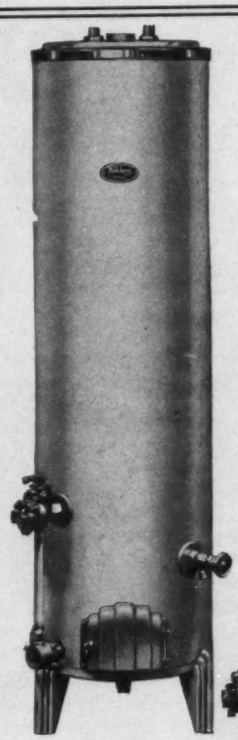
Engine Stroke in Inches	50 Cycle Generator	60 Cycle Generator
Engine Stroke in Inches	50 Cycle Generator	60 Cycle Generator
4.00	1000	1200
.25	1000	1200
.50	1000	1200
.75	1000	900
5.00	1000	900
.25	750	900
.50	750	900
.75	750	900
6.00	750	900
.25	750	720
.50	750	720
.75	750	720
7.00	750	720
.25	600	720
.50	600	720
.75	600	600
8.00	600	600
.25	600	600
.50	600	600
.75	600	600
9.00	600	600
.25	500	514
.50	500	514
.75	500	514
10.00	500	514
.25	500	514
.50	500	514
.75	500	450
11.00	428	450
.25	428	450
.50	428	450
.75	428	450
12.00	428	450
.25	428	400
.50	428	400
.75	428	400
13.00	375	400
.25	375	300
.50	375	300
.75	375	300
14.00	375	300
.25	375	300
.50	333	300
.75	333	300
15.00	333	300
.25	333	300
.50	333	300
.75	333	300
16.00	333	300
.25	300	300
.50	300	300
.75	300	300
17.00	300	300
.25	300	300
.50	300	300
.75	300	300
18.00	300	300

ANNOUNCING
1937 LINE OF
HOTZONE

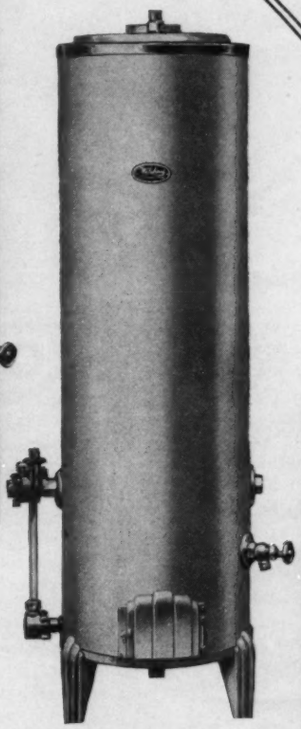
STORAGE GAS WATER HEATERS

Attractive in Design and Color

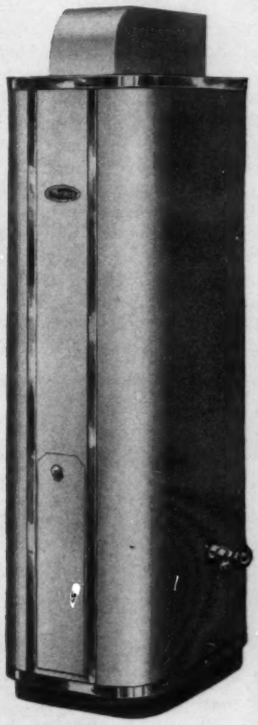
Efficient in Operation



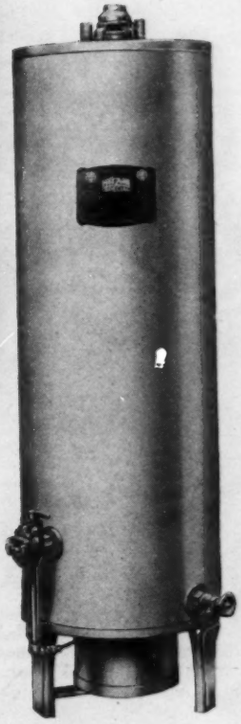
STANDARD LINE



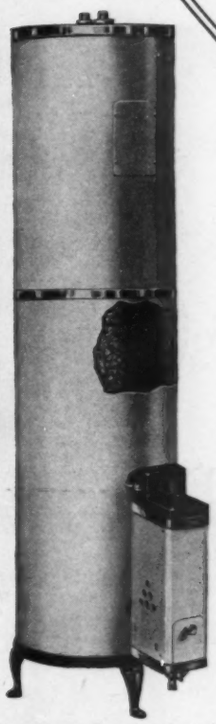
MASTER LINE



STREAMLINE



SPECIAL LINE



COMBINATION LINE

Enter the 1937 Water Heater Sales Contest with Heaters That are Outstanding in Value and Performance

WRITE FOR DETAILS

WELSBACH COMPANY

GLOUCESTER CITY, N. J.

Since 1887 pioneers in the manufacture of Gas Burning Appliances

tionable, and it is advisable to make this exhaust as quiet as possible. This can easily be accomplished by the installation of an expansion chamber in the exhaust line between the engine and the muffler. The diameter of these tanks should be approximately two to three times the bore of the engine and the length 3 feet for the smaller engines to 8 feet for the larger engines. These tanks should be buried in the ground, gravel packed, as shown in Fig. 1.

Power Take-off: When an extension shaft is required upon which to mount pulley or pulleys, it should be of sufficient diameter so that it will be rigid, and the outboard bearing should be of ample capacity and preferably of the ball-bearing, self-aligning type having a sole plate for alignment adjustment.

Pulleys should be of cast iron. Those having 3 inch or larger bore should have split hubs. Pulleys with a bore larger than 3 inches, and face dimensions over 14 inches should have split hubs with double arms.

Belts: Either leather or V-belts should be at least 25 per cent larger than the belt manufacturer's recommendation.

Idlers: These should be installed where necessary, and should have ball bearings of ample capacity. Idlers should be installed so that they will flex the belt no more than necessary. V-belt idlers should never bend the belts back on themselves, but should be mounted against the inner side of the belts. (See Fig. 2.)

Lubrication: A good grade of lubrication oil should be used. The best oil for the particular engine should be determined from experience. It is advisable to provide a dry sump lubrication system using a day tank of from 30- to 50-gallon capacity depending upon the horsepower of the engine. Small engines that do not have a dry sump should have an extra large oil capacity in the crank case. Oil filters or refiners having removable filter elements that can be replaced as necessary, can be used to great advantage on these small engines.

Foundations: One should not economize on foundations. A few additional yards of concrete are a good investment as volume and weight in an engine foundation (where the engine is to be bolted down) will tend to decrease vibration.

Estimating Gas Consumption

When considering the installation of a gas engine to replace an electric motor the first thing to consider is the difference in operating cost between purchased electric energy and gas in order to determine whether the saving will pay out the investment required within a reasonable time. This necessitates converting kilowatt hours to cubic feet of gas which is done in the following manner.

A kilowatt hour equals approximately 1.34 horsepower hours. As all electric energy metered is the energy input and in so far as the average motor losses are approximately 10 per cent, it stands to reason that the horsepower output of a motor is 1.34 less .134 or approximately 1.2 horsepower hours, which is therefore the amount of power that must be supplied by the gas engine to do the work of 1 kilowatt hour input to the motor.

The amount of gas required per horsepower hour is dependent upon the efficiency of the engine and the percentage of full load it is operating at. As the horsepower output of the engine decreases, the fuel consumption per horsepower hour increases. These fuel consumption guarantees can be obtained from the engine builder. For estimating purposes the figures below show average conditions:

Per Cent of Full Load	B.t.u. per H.P. Hour	Cu. Ft./H.P. Hr. on Basis of 1100 B.t.u. Gas
100	10,500	9.5
75	11,000	10.0
50	12,300	11.1
25	17,000	15.4

In as much as most engines operate between 75 and 100 per cent of full load, we usually figure 10 feet per horsepower hour. On this basis it would require 12 cubic feet per kilowatt hour when converting kilowatt hours to cubic feet of gas.

Assuming now that we wanted to generate electrical energy, then the cubic feet of gas required per kilowatt hour generated is figured as follows: Again figuring a kilowatt hour at approximately 1.34 horsepower hours, it is necessary, instead of deducting 10 per cent for motor losses, to add 10 per cent to compensate for generator losses that the gas engine must absorb. This 10 per cent is about the average generator loss, which varies from 12 per cent in the smaller generator to less than 9 per cent in the larger generators. Therefore the horsepower required to generate a kilowatt hour equals 1.34 plus .134 or 1.474, but for estimating and convenience it is figured as 1.5 horsepower hour.

Using the above table of fuel consumption, the following figures of gas required per kilowatt hour generated are obtained:

Per Cent of Full Load	Cu. Ft. of Gas Required per K.W. Hr.
100	14.2
75	15.0
50	16.0
25	23.1

To obtain the plant load factor, take the kilowatt hours generated, divide it by the number of hours operated and divide the result by the kilowatt capacity of the plant. *Example:* 36,500 kilowatt hours generated, 730 hours of operation with a 100 kilowatt generator and engine.

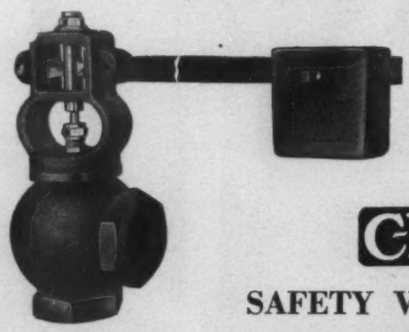
36,500 divided by 730 hours equals 50 kilowatt average demand with a 100 kilowatt generating set. The load factor would be 50 per cent, and the gas required would be 16 cubic feet per kilowatt hour generated, a total of 36,500 x 16, or 584 M.c.f. of gas.

■ ■

Move to Sell West Virginia Gas Company Approved

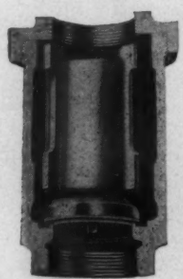
Negotiations under way for the sale of the Southeastern Gas and Water Co., serving Cedar Grove and Riverside, West Va., to Godfrey L. Cabot, Inc., have been approved by local authorities, according to news dispatches. Sale of the company will mean that the 76 consumers on the company's gas lines will be served at the rate of 25 cents per M.c.f. with a 60-cent per month minimum charge. Former rates of the Southeastern company had been 32 cents per M.c.f. and 75 cents per month minimum charge.

Blows at any desired pressure . . . . giving Sure Protection



CF

SAFETY VALVE



Lever Type *Dead Weight Type*

FOR any pressure between 5 and 100 pounds, the lever-type safety valve here illustrated is suitable. Below 5 pounds, C-F dead-weight safety valves are recommended. These valves never stick, never fail. Of superior design and workmanship, they have been proved by many years of service. The lever-type safety valve is especially adapted for use between the high-pressure and low pressure regulators of a low-pressure distribution system. Write for full information concerning safety valves and other requirements for gas control.

THE CHAPLIN-FULTON MFG. COMPANY

28-40 Penn Avenue **Pittsburgh, Pa.**

REPRESENTATIVES:

WESTCOTT & GREIS, INC.
Sales and Service
Dallas—Tulsa

Or Any Jobber

HIMELBLAU, BYFIELD & CO.
36 S. Throop St.,
Chicago, Ill.

3 New MAGIC CHEF GAS RANGES

. . . that revolutionize modern gas cooking service

SWING-OUT BROILER

The Swing-Out Broiler is an exclusive Magic Chef feature that makes broiling easier and more comfortable. By simply opening the door, the entire pan and grid with contents are swung out away from the hot zone of the broiler flame. Thus the turning of food can be comfortably and quickly accomplished without touching any part of the hot broiler. The broiler is at a convenient height so that the operator can stand comfortably erect without stooping. The specially designed broiler burner is entirely independent of the oven burner.

HIGH SPEED OVEN

The Magic Chef "High Speed" oven introduces a new standard of oven performance. The construction is of the semi-direct action type which facilitates fast heating of the oven, equalizes heat distribution and produces greater efficiency. The oven burner operates on a new principle of staggered cross fires, by which the heat is greatly intensified. This burner, combined with the semi-direct action oven principle, makes it possible to greatly reduce the time of pre-heating. On the other hand a low minimum oven temperature can be indefinitely maintained.

MAGIC Chef Series 4700, 3700 and 2700 have been emphatically approved by gas companies and dealers everywhere. They have won wholehearted and enthusiastic acceptance of consumers.

Gas companies and dealers ordered them on their faith in American Stove Company and its established record for bringing out what the industry needs at the time it needs it. The ranges stayed sold on their performance, which has not only justified this faith but has kindled an enthusiasm that promises substantial business for these timely and appealing ranges.

To mention only a few of the many advanced features that meet present day requirements these ranges provide:

More convenience and better utilization of space in top burner cooking; more efficiency, conveniences and comfort in broiling through the revolutionary Swing-Out Broiler with its specially designed broiler burner; new type high speed oven—500 degrees in 7 to 8 minutes from a cold start; low oven temperature maintenance—225 degrees or less indefinitely without creeping; better insulation; sturdier construction; easier cleaning; lower and more comfortable cooking top height; more convenient and efficient cooking top arrangements.

Our customers know that these ranges have proved themselves all that we claimed them to be and that they will do exceedingly well the job they were designed to do, namely, revolutionize modern gas range cooking service.

On these models work top and broiler grid furnished in Monel Metal at extra cost if desired.

AMERICAN STOVE COMPANY

BOSTON • NEW YORK • PHILADELPHIA • ATLANTA • CLEVELAND
LOS ANGELES • CHICAGO • ST. LOUIS • SAN FRANCISCO

LOOK FOR THE RED WHEEL WHEN YOU BUY A MAGIC CHEF

Magic Chef
AMERICAN STOVE COMPANY

The Installation of Relief Valves

(Continued from Page 20)

valve is connected; but permits the use of any pressure-relieving device which will accomplish the desired results if the pressure originates outside the vessel to be protected.

There are many instances in the oil and gas industry where a valve of the conventional type is either unable to meet the exacting requirements of the installation or is more expensive than is necessary to meet the given conditions.

Fig. 6 shows a cross section of a relief valve of unusual design which has several distinct advantages for use on gas and vapor service. I believe that this valve will meet the requirements of any of the unfired pressure vessel codes if rated at the accumulation specified by those codes. However, the valve is a low-lift valve and has a rather low capacity at the accumulations specified by the codes. Its chief virtue arises from the fact that it has a composition disc which can be replaced while the valve is in service. This composition disc is shown in the cross section near the top of the valve. A beveled metal disc is provided under the composition disc which seats and gives a shut-off when the composition disc is removed for replacement. When the composition seat is in place, the metal disc is lifted off its seat and a tight shut-off is produced by the composition disc.

Fig. 7 shows the relief valve installation at a large high-pressure holder station. The installation consists of two direct spring-loaded four-inch relief valves of conventional design and two eight-inch pilot-loaded relief valves. It has already been pointed out that it is desirable to operate high-pressure gas holders as close to the operating pressure of the relief valves as is possible, and that the relief valves have as low an accumulation as possible. The difference between the pressure at which the relief valves attain the necessary capacity and the pressure at which they start to open, produces a serious loss in holder capacity and should be kept as low as possible. Pilot-controlled relief valves of this type will operate within very narrow pressure limits and have a very high capacity. They are therefore particularly well suited for holder-station service.

Fig. 8 shows a relief valve installation on a 16-inch pipeline operating at 450 pounds' pressure. These relief valves are located at the point where the line is supplied with gas from a group of dry-gas wells having a very high delivery capacity. The installation consists of two direct spring-loaded relief valves of the conventional type, and two diaphragm-operated motor valves controlled with pressure control instruments and operating as back-pressure valves. Each pair, consisting of one back-pressure valve and one direct spring-loaded valve, is entirely independent of the other pair, and the valves between the relief valves and the pipe line are arranged so that it is impossible to shut off both pairs at the same time. The direct spring-loaded valves are set to open at a pressure approximately 100 pounds higher than the maximum working pressure of the pipe line, while the back-pressure valves are set to operate at a pressure 5 pounds higher than the normal operating pressure of the pipe line. Originally, only direct spring-loaded valves were used in this installation; however, the maximum operating pressure of the pipe line had to be held so far below the set pressure of these valves to prevent leakage, that the capacity of the pipe line was seriously reduced. The instrument-controlled back-pressure relief valves have been found to have a very narrow operating range, and to be well suited to this service.

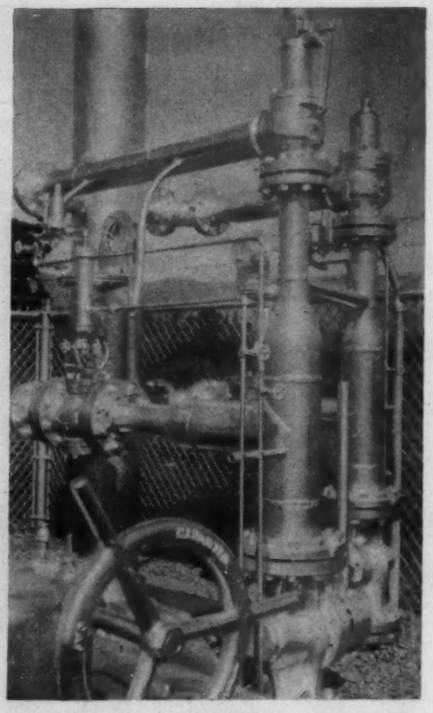
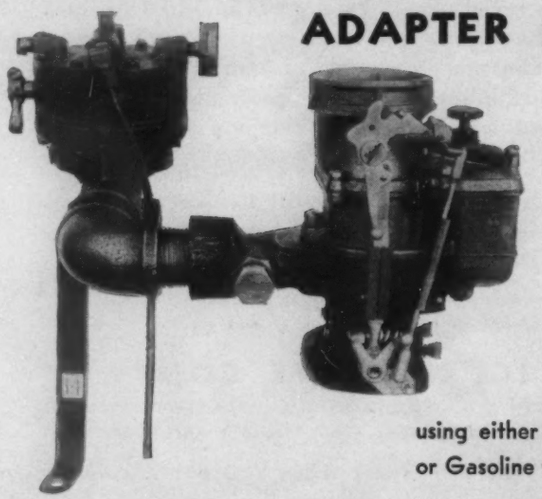


FIG. 7. Relief Valve installation at high-pressure holder station.

The reasons for the superior operating characteristics of a valve of this type are quite evident. The valve is held shut with a spring and is opened by the instrument by applying gas pressure above the diaphragm. As long as the pressure in the pipe line remains below the set pressure of the instrument, atmospheric pressure exists above the diaphragm and the full force of the spring is available to hold the valve disc tight against its seat. This condition exists right up to the instant the set pressure is reached. As soon as that occurs, the instrument opens and admits gas to the diaphragm chamber and the motor valve is forced open. If the control line for the instrument is connected directly to the pipe line (or pressure vessel, as the case may be) and not to the pipe line leading to the relief valve, a drop in pressure in the relief valve connection caused by a high rate of flow, will not affect the instrument and there will be no tendency for the valve to close until the pressure in the

FORD V-8 NATURAL GAS
ADAPTER ASSEMBLY



for operating Ford V-8 Power Units

using either Natural Gas or Gasoline for fuel

The assembly, as illustrated, is added to the standard Ford V-8 carburetor; making it possible to use either natural gas or gasoline for fuel, changing easily and quickly from one to the other. Exceptionally efficient; assures maximum fuel economy. Easily installed. Exchange credit allowed on new V-8 gasoline carburetor. Write for descriptive Bulletin No. 190.

ENSIGN CARBURETOR COMPANY
HUNTINGTON PARK, CALIFORNIA

Chicago Branch: 2644 So. Michigan Avenue. Distributors with Stocks: A. W. Schuller, Inc., Tulsa, Okla.; The Binkley Co., Oklahoma City, Okla.; Portable Rig Co., Houston, Texas; H. G. Makelim, Oakland, Calif.; T-V Supply Company, Wichita, Kansas.

There's No Mystery about PAYNE QUALITY

It's Built-in by Modern Methods in a Complete Plant Designed for Gas Appliance Manufacture

★ The processes of manufacture form the background for successful gas appliance merchandising. Payne products run the gamut in modern manufacturing methods, and the satisfaction and good will they have produced prove their superiority.

High grade metals are used throughout in the production of Payne appliances. All heating elements of Payne furnaces are completely welded, to prevent leakage of burned gases into the rooms being heated.

Burners and all machined parts are made by precision machinery under the hands of expert mechanics.

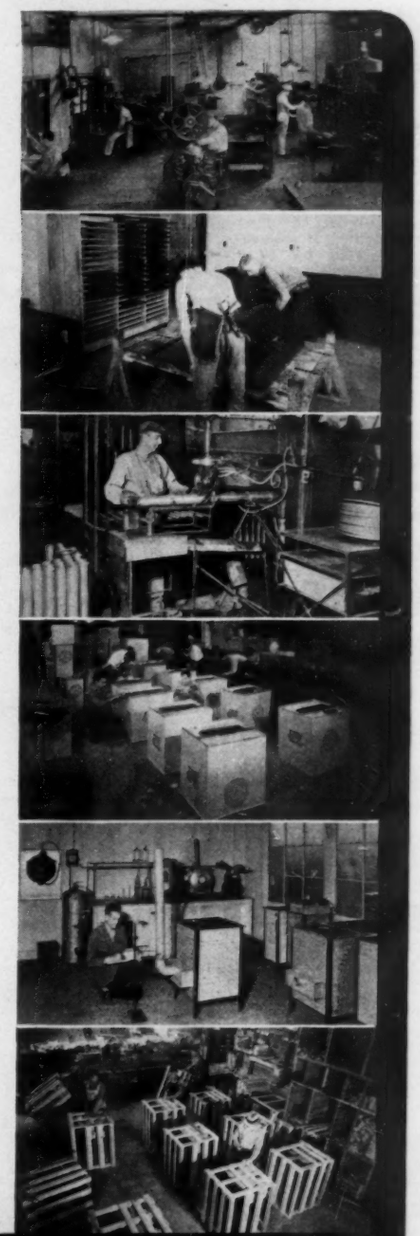
The most up-to-date equipment is used for graining, enameling and baking the various finished models of Payne appliances.

An appliance is not permitted to leave the Payne factory without first being thoroughly tested in our own laboratory, complete in every detail to carry on this work. In addition to this, Payne appliances are tested and approved by the American Gas Association Laboratory.

Twenty years of merchandising experience has shown us many of the "angles" and better methods for displaying and selling gas appliances. These methods are tried out in our own sales organization and in our own community. We are, therefore, able to cooperate fully with commercial departments of gas companies to help them formulate and carry out successful campaigns for heating appliance sales and increased heating load.

When planning your 1937 heating campaign write us for any assistance desired. Our organization and facilities are yours to command.

Convincing evidence of the facilities for producing better gas appliances is shown below in the views of the various departments in the Payne plant.



PAYNE FURNACE & SUPPLY COMPANY

BEVERLY HILLS · CALIFORNIA

You Get DEPENDABILITY
in a Gas Pressure
REGULATOR
Built By
BARBER

Made in ¼", ⅜", ½", ¾", 1", 1¼", 1½" and 2" sizes.

If there is any place in the world where a cheap product is ill-advised—it's in the case of Gas Pressure Regulators. Barber Regulators have A.G.A. Approval, complying with severe requirements as to pressure drop and precision of operation. Moderately priced for Regulators of the highest grade. Compact design, all-bronze bodies, accurate workmanship and assembly—gas-tested and inspected. These qualities ARE essential for Regulators you can install—and FORGET. Write for literature and prices on Barber Burners and Regulators.

The Barber Gas Burner Co.
3704 Superior Avenue
CLEVELAND - - - - - - - - - OHIO

*Resolved!
TO BUILD AND PROTECT LOAD IN 1937 WE WILL FEATURE THE PERMANENT
WARD
FLOOR FURNACE
* A resolution that will be taken in 1937 by more utilities than ever before. Write us for reasons why.
WARD HEATER CO., LTD.
1800 W. WASHINGTON BLVD.
LOS ANGELES • CALIFORNIA

pipe line has again fallen below the set pressure of the instrument.

Explosion heads are sometimes used to protect pressure vessels. The latest type is hemispherical in shape and is formed out of plate having the thickness required to give the bursting pressure desired. The difference between the bursting pressure of these discs and the maximum normal operating pressure must be at least 50 per cent of the maximum normal operating pressure, otherwise the discs will gradually weaken and eventually burst at a much lower pressure than they are designed to burst at. Bursting discs may therefore be considered as very crude relief valves, which, although bottle tight, have an accumulation of 50 per cent of the maximum normal working pressure and a blow-down of 100 per cent of the maximum normal working pressure. Considerable difficulty has been encountered in protecting these discs from both internal and external corrosion. They are available made of a number of different metals.

Installation Standards

The following are a few of the more important points to be watched when installing relief valves:

1. The connection between the pressure vessel and the relief valve must be large enough to handle the rated capacity of the relief valve without appreciable pressure drop. If even a small pressure drop occurs in the connection between the relief valve and the pressure vessel, the relief valve will open and close rapidly and may hammer itself to pieces. Even short connections must have a diameter at least equal to the diameter of the inlet of the relief valve, otherwise the pressure drop caused by the square edges where the relief valve connection enters the pressure vessel may cause sufficient pressure drop to produce hammering.

2. Adequate provision must be made for the reaction produced by the discharge from the relief valve.

3. Care must be taken to avoid installation strains which will distort the body of the relief valve. If a long discharge stack is used, it should be supported independently of the relief valve. The bolts used in making the flange connections to the relief valve should be drawn up evenly.

4. Stop valves should never be placed between relief valves and a pressure vessel if the pressure originates in the vessel. An exception to this rule can be made if two relief valves are used, either one of which has sufficient relieving capacity, and if these valves are connected to a three-way stop valve so designed that both valves cannot be shut off at the same time. Installations of this type are not permitted by the Boiler Code or by the California State Air Pressure-Tank Safety Code, or by the A.S.M.E. Unfired Pressure Vessel Code. They are permitted, however, by the A.P.I.-A.S.M.E. Unfired Pressure Vessel Code and the California Liquefied Petroleum Gas Safety Code.

If the source of pressure is outside the pressure vessel, a stop valve can be placed between the safety valve and the pressure vessel provided the closing of this stop valve isolates the pressure vessel from the source of pressure.

5. All metal fragments and dirt should be blown out of relief valve connections before the valve is installed.

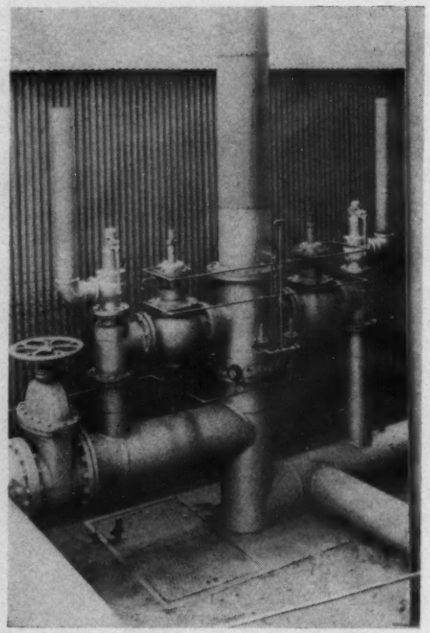


FIG. 8. Relief Valve installation on 16-inch pipe line operating at 450 pounds pressure.

The following work is required to properly maintain relief valves:

1. Relief valves should be kept in adjustment. If a relief valve is not correctly adjusted for blow-down, its capacity and operating characteristics will be seriously affected. Too small a blow-down restricts the capacity of the valve and makes its operation erratic. Too high a blow-down may cause unnecessary losses.

2. The valve should be lifted periodically to determine whether or not all moving parts are free to operate. The frequency with which this test should be made depends upon the type of service. The California State Air Pressure-Tank Safety Order and the A.S.M.E. Unfired Pressure Vessel Code specify that relief valves should be lifted once each day. The A.S.M.E. Boiler Code specifies that the valve shall be lifted during the course of each regular boiler inspection, but does not specify the frequency of these inspections. The A.P.I.-A.S.M.E. Code specifies an inspection at least once each year. It is our own practice to lift safety valve discs to holder stations once a month and to make an actual opening pressure test and capacity test once each year.

3. Any relief valve found leaking should be removed for repair at once as a leak, if allowed to continue, will score the valve seat and disc.

4. All springs should be checked to see that they are set within the range for which they are designed. Safety valve springs are designed for specific operating pressures and should not be set for pressures that exceed the designed pressure by more than 10 per cent.

In conclusion, I wish to acknowledge the assistance of Mr. George Christian of the Crosby Steam Gage and Valve Co., and Mr. Eric Grimsley, representing the Consolidated Ashcroft Hancock Co., both of whom responded very helpfully to my appeal for information.

H. P. Mueller (right) and chief engineer E. A. Jones discuss design of new unit with a member of Mueller's engineering department.

IT PAYS TO BE ALERT

WHILE I was still young enough to think that running a business was easy, my father impressed me with this simple fact—"Times change but human nature is always the same."

It took me a long time to figure that out. Sometimes people confuse changing times with a change in human nature. That's a mistake. It's human nature to reach up for something better. It's human to want improvement. That's what makes times change. As human beings get used to their clothes, their motor cars, their heating systems, they want improvements — they become restless for change. It pays to be alert to these human wants. The man or manufacturer who can sense the public desire for change is prepared to profit and improve his position by supplying the products the public wants.

For 80 years it has been a policy of the Mueller Furnace Company to be alert to people's changing wants. It has brought us from the filigreed stove through the pioneering of automatic heat and air conditioning.

Again alert to the changing public wants, we take pride in offering our improved line of Mueller heating and air conditioning equipment for 1937. The public, long under buying restraint, is about to go on a spending spree—and according to economists, most of the money will be spent to improve the home.

This is your chance to reap the rich rewards that come to those alert men who take the tide at flood.

Look over the Mueller heating and air conditioning equipment which has been improved to meet present day demands. Be ready to cash in on the demands in your city. Join the ranks of those alert men who will be among the first to profit by the return of prosperity.

Write today for Mueller Catalog G-1.

H. P. Mueller

PRESIDENT

MUELLER PRESENTS ITS 1937 PRODUCTS

EVER alert to changing public trends Mueller proudly presents its improved line of heating equipment for 1937. Crinkle finish lacquer, which proved so popular on our deluxe models last year, will be standard on most 1937 equipment.

Look over the new and improved models on these pages. See the new Mueller catalog which describes the entire Mueller line in detail.

MUELLERAIRE UNIT HEATER

Here is a unit that finds ready sale to stores, shops, showrooms, small factories and such commercial applications where the unit is to be installed within the space to be heated. The Muelleraire heats, filters and humidifies the air and distributes it by forced circulation. Heat transfer units are Gas Era pressed steel sections. Readily installed. Simply connect gas, water, electricity and vent, and attach cowl or duct.

MUELLER GAS ERA BOILER

Adaptable to steam, hot water or vapor heating. The Series "A" (54 inches high and 28 inches deep) are ideally suited to small home heating. They are also adaptable to any system of heating or air conditioning employing radiation, convectors, pipe coils, unit heaters or blast heating surfaces. Go after this profitable gas load. Get all the facts about these remarkable Mueller Boilers. Write at once.

MUELLER-MILWAUKEE

SCIENCE AND ENGINEERING SKILL CREATED

GLO-FIRE

APPROVED ODORLESS GAS LOGS

ODORLESS
REALISTIC
ECONOMICAL
A.G.A. APPROVED

Equipped with slotted venturi type burner it assures fool proof operation. Approved also as an unvented appliance. Perfect combustion through preheated secondary air—A truly modern gas heating appliance.

WRITE TODAY FOR DETAILS
EXCLUSIVE DISTRIBUTORS

COLONIAL SHOPS
Glo-Fire Sales Division
3350 W. FIRST ST. LOS ANGELES, CAL.

In Los Angeles
it's the
HOTEL
CLARK
Fifth and Hill

555
Rooms-Baths

From $2.50 PER DAY

Famous for Good Food from Coast to Coast

RIGHT downtown in the center of things. Easy chairs, sleep-inspiring beds, large rooms with luxurious fittings.

P. G. B. MORRISS
Manager

One of the biggest features of this year's National Power Show, the world's largest "get-together" of power men, was the gas exhibit sponsored by the Industrial Gas Section of the American Gas Association in co-operation with the Consolidated Edison Co. of New York, The Brooklyn Union Gas Co., and the New York and Richmond Gas Co. Held in New York, November 30-December 5, this year's show occupied three floors of the Grand Central Palace. The gas exhibit was the largest of all exhibits, and was favorably located just to the right of the main entrance on the first floor.

L. A. Companies in Biggest Day Serve 450,000,000 Feet

DEPENDABILITY of natural gas service in Southern California was demonstrated on December 30 when the local gas companies, the Los Angeles Gas & Electric Corp., the Southern California Gas Co., and the Southern Counties Gas Co., were able to meet successfully the greatest demand ever made for gas fuel in their history. The total amount of gas delivered on December 30 was 450,000,000 cubic feet, as contrasted with 235,000,000 cubic feet a day during the previous warm weather.

It was necessary, in order to meet the demand of domestic consumers, to turn on the big artificial gas plants, which enabled the gas companies to give the communities they serve uninterrupted gas service during this critical period. The four artificial gas plants are located, two in Los Angeles, one in Colton, and one in San Diego, and produced a total of 20,000,000 cubic feet during the day. The Los Angeles Gas and Electric Corp. alone sent out over 150,000,000 cubic feet of gas on that day, 10,600,000 cubic feet of which was required between 5 and 6 p.m.

■ ■

P. G. and E. Offers Employees Company Retirement Plan

IN ADDITION to and separate from the old age income provisions of the Social Security Act, Pacific Gas and Electric Co., San Francisco, Calif., employees are offered a new retirement plan effective January 1, 1937. Cooperating insurance companies are the Metropolitan and the Prudential. While participation in the plan is voluntary, to put it into operation 75 per cent of all present employees must sign up. This percentage has been exceeded. Retirement age is 60 for women and 65 for men. All present employees under these ages who have completed one year of continuous service are eligible.

Both employees and the company will contribute to the fund, employees paying 2 per cent of the first $3000 of annual earnings and 4 percent of earnings in excess of $3000. The company will add the balance of the cost necessary. Annual retirement income will be one per cent of total earnings upon which the employee has contributed 2 per cent, and 2 per cent of the earnings upon which he has contributed 4 per cent. In case of death either before or after retirement, the employee's contribution or balance thereof will be paid to his beneficiary. Several options are available to employees who terminate their service with the company before retirement. As long as an employee remains with the company his contributions may not be withdrawn and have no loan value.

This funded plan covers only service after January 1, 1937. In addition the company hopes and expects to recognize service prior to that date solely at its own expense.

■ ■

May and Denning Receive New Posts in Texas Companies

CHESTER L. MAY was elected executive vice-president and general manager, effective December 1, 1936, of the Community Natural Gas Co. and the Texas Cities Gas Co., Dallas, Texas. He was formerly vice-president and general manager.

Effective December 1, L. B. Denning, Jr., was elected a director and vice-president and operating manager of the Community and Texas Cities Companies, in charge of all operations under Mr. May. Mr. Denning was superintendent of the eastern division.

■ ■

Bring In Large Gasser

A 34,000,000 foot well drilled by the Cunningham Natural Gas Co., Wellsville, N. Y., on the Thomas Burns lease was the sixth large well to be brought in in the township of Alma, Allegany Co., according to J. T. Cunningham, president.

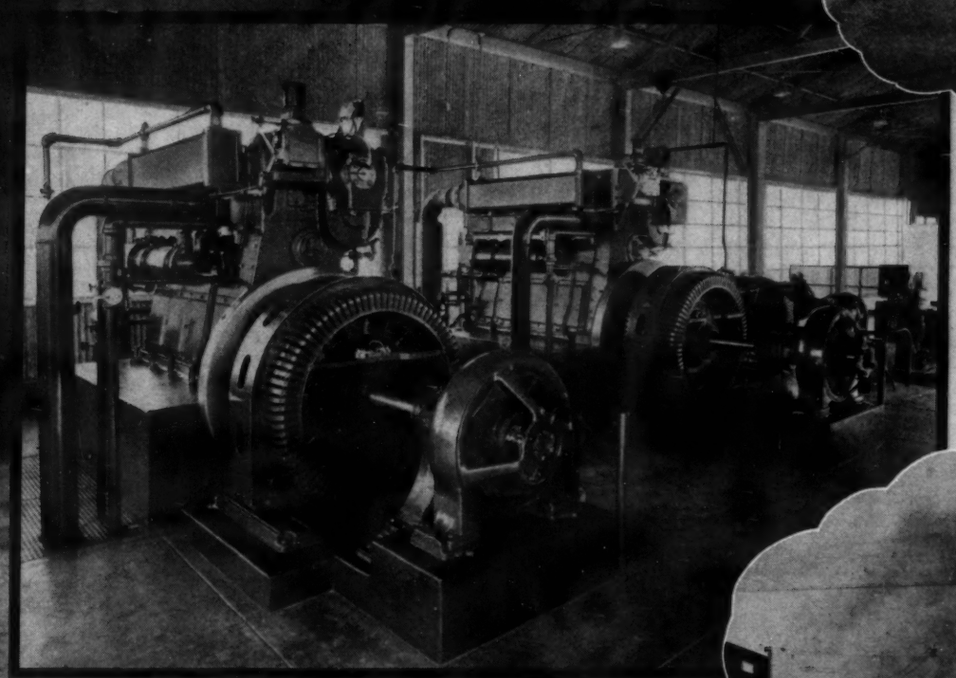
DUST-DUST EVERYWHERE

···BUT THE *Engines* MUST *Keep on Running!*

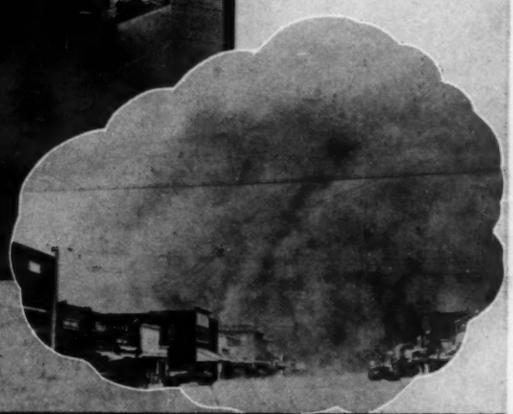
OCEANS of black dust turning day into night . . . sweeping along at a mile a minute! That's where Cooper-Bessemer RELIABILITY meets the supreme test!

A striking example is the country along the Panhandle-Eastern line. Even when the dust drives women and children away . . . the Engines MUST GO ON— because Detroit must have gas!

Cooper-Bessemer main and auxiliary power *has to operate* under such conditions.



Panhandle-Eastern's Type GN-4 Generator sets are just as RELIABLE as the Cooper-Bessemer 1300 H.P. main units. These two auxiliary sets at Haven, Kansas, are each rated 200 H. P. at 400 r. p. m.



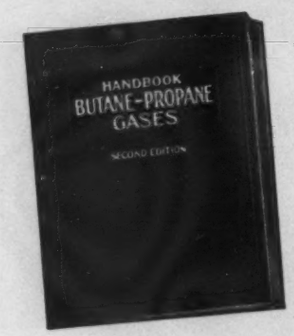
THE COOPER-BESSEMER CORPORATION

Mt. Vernon, Ohio — PLANTS — Grove City, Pennsylvania

25 West 43rd Street, New York City
Mills Building, Washington, D. C.
640 East 61st Street, Los Angeles, Calif.
201 East 1st Street, Tulsa, Oklahoma
631 Spring Street, Shreveport, La.
Magnolia Bldg., Dallas, Texas
Esperson Bldg., Houston, Texas

1937 Supplement — Handbook of Butane-Propane Gases

1 ADVERTISEMENT *that works for* 2 *years!*



Over 3,000 copies of the First and Second Editions of the Handbook of Butane-Propane Gases have been sold at $5.00 per copy. The 1937 Supplement will be sent to all previous purchasers of the Handbook 2nd edition and to all future buyers.

Practically the entire issue of GAS for March, 1937, will be devoted to the subject of Butane-Propane Gases. After the March issue has been published, all of this material together with additional statistics, directories and other pertinent data will be published in book form as the 1937 Supplement to the Handbook of Butane-Propane Gases.

This means that one advertisement, inserted in the March, 1937 issue of GAS, and appearing in the Supplement, will work for two years and will reach a circulation of over 6,000.

ONE advertisement in the March, 1937 issue of GAS and in the 1937 Supplement to the Handbook of Butane-Propane Gases represents the only certain method of reaching this rapidly developing Industry — the only opportunity to reach this industry with full coverage for another two years.

No other medium—no other mailing lists —can provide this coverage. Distribution is international.

Advertising space in the March, 1937, issue of GAS will be sold at regular card rates. A $25 additional charge will carry the same copy in the Handbook Supplement.

Space reservation should be made at once. Preference will be given to early orders. First forms close January 25th. ACT NOW!

LOS ANGELES
810 South Spring St.

GAS
FORMERLY WESTERN GAS

CHICAGO
1064 Peoples Gas Bldg.

Publishers—Handbook of Butane-Propane Gases—1st and 2nd Editions

The Goodman Stopper

The Reliable Shut-off for Street Mains

Equipped with Improved Patented Locking Sleeve, which locks both handles to the pipe. Stopper cannot slip. Gas cannot pass.

Safety Gas Main Stopper Co.
523 Atlantic Avenue, Brooklyn, N. Y.

Pac. Coast Rep.: C. B. Babcock Co.
135 Bluxome Street
San Francisco, California

Rheem Co. Appoints Hoyt To California Sales Post

W. L. HOYT has been appointed sales manager of the Water Heater and Heating Division of the Rheem Manufacturing Co. of Southgate, Calif. For the past six years Mr. Hoyt has been Los Angeles manager for the H. R Basford Co. of San Francisco, and was formerly connected with the American Gas Products Co. of New York as Pacific Coast manager. Mr. Hoyt will be located at the Southgate, Calif., factory.

W. L. HOYT

The Rheem Company is placing on the market a new line of heating and water heating appliances under the Rheem name. The company has just completed a new factory at Houston, Texas, which will be in charge of R. R. McLachlen, located at 1901 Lockwood Drive, Houston. G. McGaughey will be located at the Richmond, Calif., factory of the Rheem company, and will handle sales in Northern California and the Pacific Northwest territory.

■ ■

Consumers Power Completing Broomfield Compressor Station

CONSUMERS Power Co., Jackson, Mich., is this month completing construction of a compressor station at the Two Rivers station just east of the Broomfield gas field in central Michigan. It is the first compressor station installed in lines from central Michigan fields.

Two compressors are being set up to increase the natural gas line pressure to insure steady delivery to Saginaw Valley consumers. The Broomfield pool's gas well pressure has dropped from 600 pounds, according to press stories, to a point where it is insufficient for delivery in adequate volume to Saginaw and Bay City.

A pipe line from the Tri-Township field connects with the Broomfield-Saginaw line at the Two Rivers station. The compressors are mainly to permit drawing from the older Broomfield field.

■ ■

Minneapolis Co. Advertising Reaches 76,000,000 in 1936

During the fall of 1936 the Minneapolis Honeywell Regulator Co., Minneapolis, Minn., in its advertising campaign carried 45,000,000 messages on automatic gas heating and gas air conditioning to readers of national magazines and metropolitan daily newspapers. In addition the sales message was put before hundreds of dealer meetings throughout the year. Coupled with the Spring campaign, total messages circulated by the Minneapolis company during 1936 reached the 76,000,000 mark.

To supplement this broad national advertising campaign the company supplied posters, window and counter displays, consumer booklets, leaflets, and folders.

BUTANE-PROPANE NEWS

Bottled Gas As An Ally To Piped Gas Service

By H. EMERSON THOMAS

President, National Bottled Gas Association, Inc.*

THE gas industry is one of the basic industries in the United States and has well served its public. Unfortunately, due to the necessity of distributing its products through mains, the actual square mileage that could possibly be served was only a fraction of the total. By the nature of its physical set-up, its service has been generally restricted to the cities and larger towns. Even in the natural gas territories, only a part of the total population is served.

H. EMERSON THOMAS

This vast unserved market, because it has been unreachable by gas mains, has been opened up as a great frontier of development by the bottled gas part of the gas industry. Thus, the gas industry as a whole has found a frontier into which to expand through cooperation with bottled gas marketers. This is made possible because bottled gas is not restricted in its territory by fixed investment in gas mains. Bottled gas today is available in every state in the Union and in many foreign countries.

I do not want it to appear that there are no other avenues than bottled gas for expansion in the gas industry. Natural gas is constantly expanding in usage to new territories, but its major expansion is to serve existing gas customers through conversion from other types of fuels. Also, the gas as a whole is expanding its sales by new and additional uses, such as refrigeration, water-heating, air-conditioning, space heating and many other uses where gas is the ideal fuel. I believe the Gas Industry will, with an aggressive sales program and a fearless competitive policy, forge ahead to new and astonishing attainment of volume sales.

To give you a complete picture of the bottled gas industry, I will briefly cover its development as set out in the Bureau of Mines Yearly Reports, the first of which was reported in June, 1930. Bottled gas was first produced and marketed around 1910 (Blaugas also marketed) but did not grow to any proportions until 1922. From 1922 to 1928 approximately 20,000 customers were obtained as users.

The slow development during this time was due to several factors:

1. The initial cost of utilization equipment was about $150 to $200, which could attract only the wealthy type of trade.

2. The general lack of regard for properly designed burners which resulted in low efficiency.

3. The price of the gas was $.18 to $.20 per pound. This again placed the range of prospects only in the higher income bracket. I believe that this will be apparent to everyone, when it is pointed out that these prices compare with city gas at about $4.50 per thousand cubic feet when the low efficiencies as mentioned above, are considered.

4. Poor service set-up.

The outstanding reason for the above conditions is that the industry was based on an incorrect development foundation. Apparently all policies were predicated on making a large merchandising profit rather than lowering initial cost so as to broaden the market and thus sell more gas.

In or about 1928, several large units entered the Bottled Gas business and new ideas and policies wrought an immense change in its development. Old ideas were junked and a new approach was made. It is interesting to note that the bottled gas industry almost identically followed in the steps of the manufactured and natural gas industries by discarding its short pants and outmoded policies and in their stead adopting long pants with changed, advanced ideas.

From this time (1928) on, slow sales increases gave way to an accelleration almost unbelievable. It is also interesting to note that the bottled gas growth really took place in the depression years. While approximately 20,000 users enjoyed bottled gas service in 1928, this number had increased to approximately 250,000 in 1935. The reasons for such a rapid increase were:

1. A lowering of the initial cost to customer from outright sale price on equipment of $150 or $200 to an installation charge (marketer owning equipment) of $36.50, and for the past two years a consumer has been able to secure gas service beyond gas mains for only $9.75.

2. Gas prices were reduced to a top price of $.12 per pound (approximately $2 City Gas) with lower prices for large quantities.

3. Appliances of high efficiency were demanded and marketed by the majority of the marketers.

4. Service to the user was improved. This was essentially by giving the customer an uninterrupted supply of gas, either by a tank truck delivery system or by an automatic regulator changeover device which turned on the reserve cylinder of the two-cylinder type equipment when the initial cylinder became exhausted. Another added improvement was the monthly billing of the user for gas consumed rather than such user purchasing a cylinder of gas in advance.

The bottled gas industry has carried on intensive research into equipment improvements, delivery methods, merchandising plans, dealer cooperation, appliance efficiency, rate making, etc., to better meet competition outside of the gas industry.

The bottled gas industry believes that for the greatest value to be obtained the entire gas industry should and will cooperate to the fullest in order to take an aggressive attitude toward outside competition. It is felt that both industries are competing, not with each other, but with other industries who are trying to obtain the prospects' dollar, whether it be for an automobile, a radio, a vacation or a membership in the golf club.

As the bottled gas group pushes forward in its attack on the gas sales frontier, it is developing customers that may later be served by gas mains. This widespread aggressive activity is selling the gas idea and will help keep gas paramount in the public's mind as The Fuel.

The development of bottled gas users on the fringe territory around main distribution centers makes possible both main extensions at lowest possible capital investment and a full customer load with resultant profits where such would not be possible to the same extent without this allied program. It is estimated that in the past eight years not less than 20,000 bottled gas users have been converted to gas users on the mains. This partially in the depression years when few main extensions were made.

In a quick glance at the gas industry today I see a picture of hundreds of fine gas production plants or natural gas areas with unsurpassed distribution systems but each of these units is surrounded with a wall. The people on the inside enjoy gas service and think of it as a universal fuel. On the outside of the wall are many strong, well developed bottled gas groups selling the idea of gas in those territories where the wall has shut off the full view to the marvelous gas advantages within. At one time this wall seemed insurmountable but gradually during the past few years and increasingly so today the stones from the top of the wall are being removed, holes are being shot through its too many times thought of immovable mass.

Many city gas companies in the past have hesitated to recommend bottled gas to people beyond their gas mains, because they felt the cost of usage was too high. They felt, and in the past, justly so, that there was too great a jump between the city gas rates and the rates just beyond the mains. Today, however, the picture has entirely changed. Bottled gas is being offered at rates which are comparable with many city gas rates and in cases

*Delivered before Eighteenth Annual Convention, American Gas Association, Atlantic City, N. J., October 26-30, 1936.

actually lower. One company, for example, has instituted a rate offering all gas for automatic water-heating or refrigeration at a price comparable to city gas at $1.04 per M. c.f. This is offered to domestic consumers who also are using a major cooking appliance, the cooking rate starting about $2 and sliding down on increased volumes. In this case, the gas to the water heater or refrigerator is metered and segregated from the balance of the load. Consequently, a very low average may be secured. Other companies, while handling it in a little different manner, also have instituted comparable rates. Low commercial and other types of large load rates are available. Quite a different picture from $4.50 gas of not so many years ago. The bottled gas companies are truly extending real gas service beyond the mains today. The gas industry today, whether in the country or in the city, presents a possibility for a solid front.

The main promotional barrage, to give fullest evidence to the public that gas is the Universal Fuel, is, I believe, being made by the bottled gas industry. In cases groups within the wall are doing a splendid job of bringing about the same ultimate goal. I believe that the picture warrants the fullest cooperation from all of the gas industry in selling gas.

This can be accomplished in the following ways:

1. Advertise gas as a fuel on the mains and beyond the mains.
2. Cooperative sales schools.
3. City gas groups display bottled gas equipment to prove to the public that gas is available anywhere.
4. Continue work of increasing appliance efficiencies on bottled gas as well as city gas and natural gas ranges.
5. Appliance manufacturers advertise "Modern Gas Appliances Available Beyond Gas Mains through Bottled Gas."
6. Institute an educational program to gas companies and their employees so as to get the entire industry awake to the necessity of publicizing gas as the Universal Fuel.

■ ■

Bottled Gas Men to Meet in January in New York

The annual meeting of the National Bottled Gas Association will be held at the Waldorf-Astoria, New York, on Wednesday, January 20.

All members of the Association have been invited by Compressed Gas Manufacturers' Association to attend its session on Safety in the Compressed Gas Industries. This meeting will be held at the Waldorf-Astoria on the day preceding the N. B. G. A. meeting.

■ ■

Hope Natural Line Completed

Hope Natural Gas Co., Pittsburgh, Pa., has just completed and put in operation a 12-inch, 95-mile natural gas line between Clendenin and Hastings in West Virginia. Ligon & Ligon of Baltimore, Md., were the general contractors.

Blythe, Calif., Grants Franchise For Butane Gas Service

THE city of Blythe, Calif., last month granted an exclusive 50-year gas franchise to L. R. Lackey of the Southwest Gas Corp., which will supply the city with a butane gas service in the near future. After the first 5 years, the city will receive 2 per cent of the gross annual receipts.

The Southwest Gas Corp. plans to spend $30,000 in the installation of a gas plant and a distribution system. Minimum charge for a domestic customer was set at $1.50 for ten pounds of gas.

The gas will be brought to Blythe in tank cars to be stored in a 4000-gallon welded steel storage tank.

■ ■

Servel Appoints W. T. Wyatt Canadian Representative

WILLIAM T. WYATT, Dallas, Texas, has been appointed Canadian sales representative of Servel, Inc., manufacturers of gas-operated and kerosene-operated Servel Electrolux refrigerators at Evansville, Ind. Mr. Wyatt assumed his duties with headquarters in Toronto on January 1.

For the past two years, Mr. Wyatt has been a representative of Servel in Texas, where he aided in extending the company's selling set-up of its kerosene-operated refrigerator. Previously he was affiliated with the company's sales organization in California for eleven years. Mr. Wyatt has been with Servel since 1923.

■ ■

Iowa Co. Installs Propane Tank at Red Oak

An 18,000-gallon propane storage tank will soon be installed by the Iowa and Nebraska Power and Light Co. at its Red Oak, Ia., plant. The propane will be used to operate two 1,800 horsepower natural gas-fired engines connected with generators, at such times as it is necessary to curtail demand or when the supply of natural gas is inadequate. A large Kemp machine will be used for partial pre-mix of propane and air.

This concern is a subsidiary of the United Light and Power Co.

■ ■

West Texas Co. To Furnish Butane in San Angelo

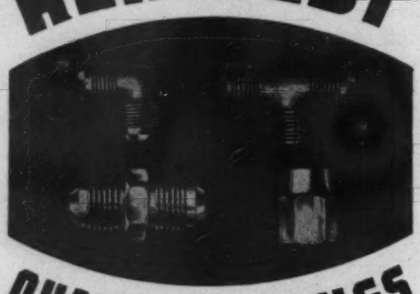
The West Texas Gas Co. of San Angelo was organized December 16, for the purpose of furnishing West Texas with butane gas and gas systems, stoves, ranges, and water heaters. This organization is located in San Angelo, Texas. The company is owned and operated by Gay Copeland. The sales manager is Gradon Osborne.

■ ■

Brockton Gas Light Co. Adds Propane Plant

A propane installation for the enrichment of manufactured gas has been made by the Brockton Gas Light Co., Brockton, Mass. The propane will be admitted to a line serving a customer company, the Norwood Gas Co., at Norwood, Mass. The daily send-out of the line is approximately 110,000 cubic feet.

KEROTEST



QUALITY FITTINGS

for every propane gas installation

Kerotest Fittings of heavy design are the work of master craftsmen and comprise a complete line of S.A.E. flare crosses, tees, elbows, unions, and nuts for your copper tube installations of propane gas.

Each one is individually inspected to insure smooth, finished seats and clean-cut threads — then individually protected by cardboard ferrules and carefully packed in strong, iron bound boxes,—your assurance of receiving them in factory-perfect condition.

KEROTEST MANUFACTURING COMPANY
PITTSBURGH, PA.

Butane

GAS PLANTS
BULK STORAGE STATIONS
AUTOMOTIVE CONVERSIONS

ENGINEERING
FUEL SUPPLY
EQUIPMENT

AMERICAN LIQUID GAS CORPORATION
650 South Grand Avenue • Los Angeles, California

Philgas "Old Stove Contest" Draws Ancient Trade-ins

A NOVEL range campaign, the "Old Stove Contest," is a current sales promotion effort of the Philgas department of the Phillips Petroleum Co., Detroit, Mich., according to word from Ross Thomas, general manager of Philgas. The company is offering as prizes in each Philgas district two new Philgas ranges and installation—one to the person turning in the oldest kerosene, gasoline, or electric range in active use, and one for the oldest coal or wood range in active use.

Announcing the campaign by direct mail with a half million special broadsides, the company found that many who responded offered for trade-in makes of ranges long out of existence, some of which had been in constant use since before the turn of the century.

Realizing that many people receiving the broadsides would not enter the contest because their stoves, while old, were not ancient, company officials took care to include an offer of a special limited-time, trade-in allowance on any old stove toward the purchase of the new Philgas Table Top model No. 37; or on any old coal or wood stove toward the purchase of the Bungalow model No. 52.

■ ■

Panhandle Eastern To Build Line in Missouri

PANHANDLE Eastern Pipe Line Co., Kansas City, Mo., is reported to be preparing the construction of a gas pipe line from a booster station at Centralia, Mo., to Louisiana, Mo., and eastward, paralleling a line that was laid several years ago.

A booster station for the Panhandle company has been completed near Pleasant Hill, Ill., and will be taken over soon, according to press dispatches.

■ ■

Al Rice Leaves Basford Co. To Join Kelvinator Corp.

Al Rice, formerly sales manager for H. R. Basford Co., San Francisco, has become district manager of the Kelvinator Corp., covering California and Arizona. His offices are now in the Sharon Building, San Francisco. Mr. Rice had been with the H. R. Basford Co. for eleven years, and during that time became prominent in the gas industry on the Pacific Coast through his sales work and through his activities with the Pacific Coast Gas Association.

■ ■

Okla. Co. Transfers Managers

J. A. Ray, manager at Tulsa, Oklahoma, for the Oklahoma Natural Gas Co., has been appointed manager of the Enid district. He succeeds Ben L. Maulsby, who was transfered to Virginia. Mr. Ray has been with the Oklahoma company for 18 years.

■ ■

Texas Company Moves Office

The McKinney office of Community Natural Gas Co., Dallas, Texas, has moved to enlarged quarters in the Merritt building. Frank Williams is local manager.

LIGHT ON WEIGHT—HEAVY ON STRENGTH

The scales prove the weight economy of Hackney liquefied petroleum gas cylinders. Long years of trouble-free service prove their strength.

Back of these important factors lies the efficiency of design, workmanship and raw materials of Hackney cylinders.

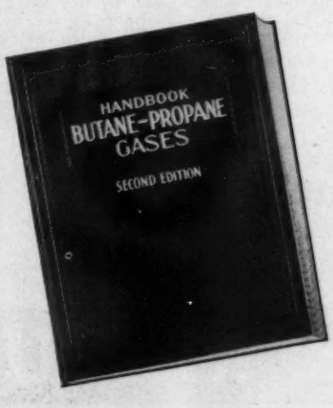
Because Hackney cylinders are light on weight and heavy on strength, they are preferred two to one against all others combined. They carry Butane, Propane, and Butane-Propane mixtures for virtually all the leading companies in this field.

Hackney MILWAUKEE

PRESSED STEEL TANK COMPANY

Rm. 1185—208 S. La Salle St. Bldg., Chicago, Ill.; 6633 Greenfield Ave., Milwaukee, Wis.; 666 Roosevelt Bldg., Los Angeles; 1363 Vanderbilt Concourse Bldg., New York

Containers for Gases, Liquids and Solids



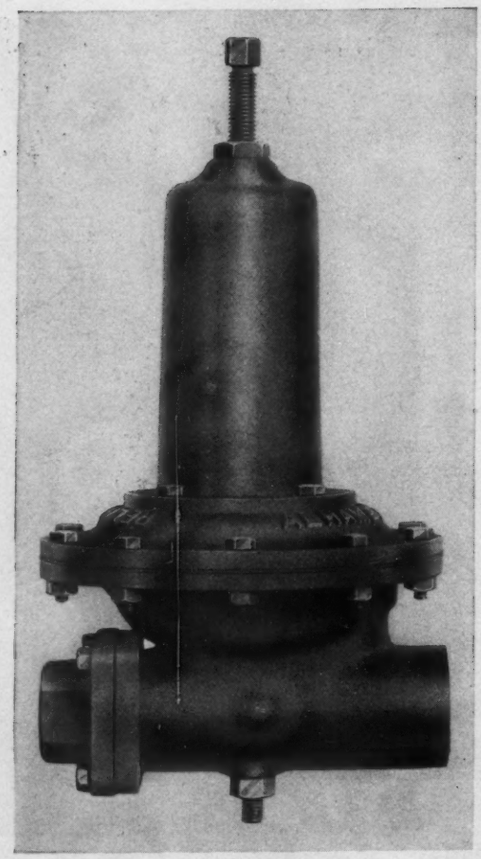
Big Second Edition
Now Available

CONTENTS: Summary of Two Years' Developments: Use in Internal Combustion Engines: Designs and Installation of Storage: Supply from Petroleum Refineries: Engineering Data on the Lower Olefins: Domestic Appliance Testing and Utilization: Economic Comparisons with Coal, Oil, Electricity, Producer Gas, Manufactured Gas: Town Plants: Manufacture from Natural Gas: Special Uses: Volume Correction Factors: Supplements and Revisions: Transportation: Use with Other Gases: Analysis and Testing: Properties of Mixtures: Bottled Gas Distribution: Bibliography: Central Plant Directory: Catalogue Section:

$5.00—Send Check or Money Order To

GAS, *Publishers*
809 So. Main St., Los Angeles, California
Write for circular describing contents in detail.

Down



Above. Reliance High Pressure Compounding Regulator. Fully Patented.

from 800 Pounds

to 5

Reliance High Pressure Compounding Pounds to Pounds Regulators are extremely compact and suitable for installation in small spaces. They will efficiently deliver outlet pressures as low as two pounds. Outlet pressures range up to seventy-five pounds and may be obtained merely by using a reducing ring and the proper adjusting spring, but the compounding feature will not function on pressure above six pounds.

The capacity of these Regulators greatly exceeds that of any other regulator of equal size on the market. Outlet pressures are locked up with safety on primary pressures as high as 800 pounds. The valve seat has the same assembly as the standard line of Reliance Regulators, is very accessible and can be replaced in the field.

Made in three sizes: ¾", 1" and 2", with orifices of various sizes according to the operating pressure required. These regulators embody every desirable feature without the use of attachments and have been giving perfect satisfaction for years.

Reliance Regulator Corp.

Send for Bulletin

1000 Meridian Avenue Alhambra, California

REGULATORS YOU CAN RELY ON — RELIANCE — SINCE 1910

RELIANCE REGULATORS

MEASUREMENT and CONTROL

THE SLIDE RULE

Its Use to Determine Combined Correction and Superexpansibility Factors In Gas Measurement

By W. E. HELMICK
Shell Oil Company * †

FEW gases follow Boyle's law above a pressure of two atmospheres, and to correct for the itineracies of the particular gas, deviation factors are applied to adjust the volumes to some standard pressure. Superexpansibility factors apply when the gas is expanded to reach the pressure base; and similarly, supercompressibility factors, which are the reciprocal of the former, apply when the gas is compressed.

When superexpansibility factors of natural gases are applied to measurements involving displacement meters, pressure storage, pipe line flow formulae, underground reserves, adiabatic expansion or any calculation wherein a pressure-volume change occurs, the factor Y is to be used. Boyle's law corrected for superexpansibility is then

$$P_1 V_1 = Y \times P_2 V_2 \quad \text{.....(1)}$$

in which Y equals the superexpansibility factor for displacement meters ($= F^2_{pv}$), and in which the subscript 1 refers to the base conditions of pressure and standard volume, and the subscript 2 to the higher pressure-volume conditions at which measurement values are obtained.

The equation for computing orifice meter gas flows follows:

$$Q = C \times F_g \times F_t \times F_{pv} \times F_e \times F_r \times \sqrt{h \times P} \quad \text{.....(2)}$$

Where

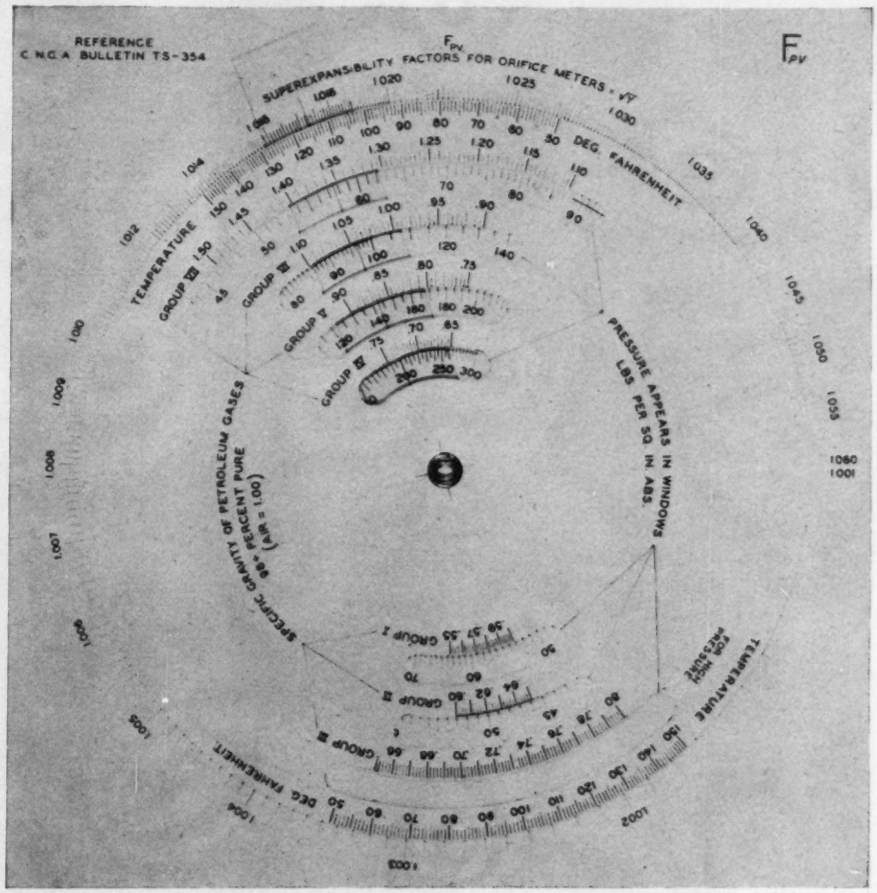
- Q = Volume rate of flow in cubic feet per unit of time
- C = Unit gas coefficient (14.73 lbs./sq. in. abs. at 60° F.)
- F_g = Specific gravity correction factor = $\sqrt{1/G}$
- F_t = Temperature correction factor = $\sqrt{520/460 + °F.}$
- F_{pv} = Superexpansibility correction factor = $\sqrt{Y}$
- F_e = Expansion correction factor
- F_r = Reynolds' number correction factor
- h = Differential pressure, ins. of water
- P = Flowing pressure, lbs./sq. in. abs.

For square root charts, $\sqrt{h \times P} = M \times h_s \times P_s$ where M = chart factor, and h_s and

(Turn to Page 52)

* Presented before the Southern California Meter Association, October 29, 1936.

† Slide rules and equations copyrighted 1936. All rights reserved.



—Copyright 1936, by W. E. Helmick.

FIG. 1. Slide rule for superexpansibility factors of natural gases for orifice meters.

INSTRUCTIONS:

Set the index line on the *absolute pressure,* which appears in the window corresponding to the *specific gravity group No.* Revolve the rotor until the *specific gravity* is opposite the *pressure* and on the index line. Holding the rotor stationary, set the index line on the *temperature,* and obtain the *superexpansibility factor* opposite the temperature and on the index line.

Example: Group III, S.G. = 0.671, P = 401.73 lbs./sq.in.abs., T = 78°F., F_{pv} = 1.0378

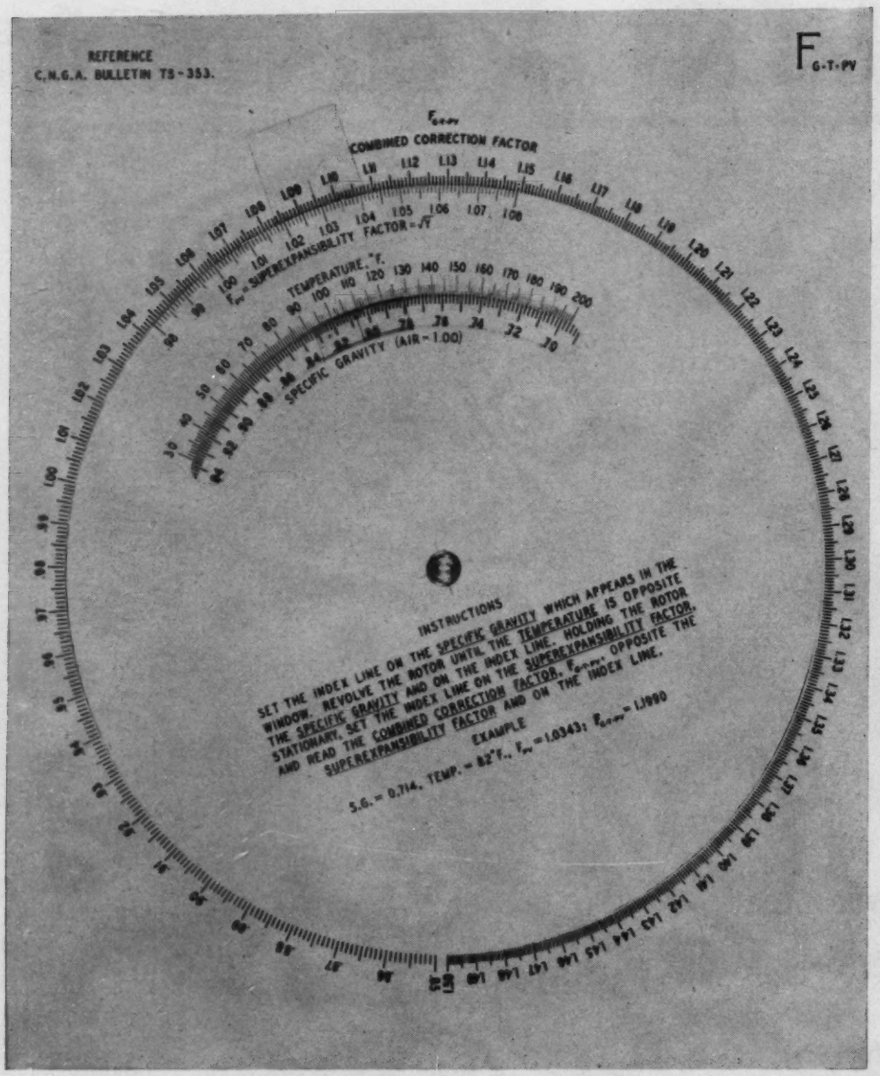
Empirical Equation

$$F_{pv} = \sqrt{1 + \frac{P_g \times k' \times 10^{z \times SG}}{T^{3.825}}}$$

Where F_{pv} = superexpansibility factor for orifice meters
P_g = line pressure, lbs. per sq. in. gauge
SG = specific gravity, (air=1.000)
T = line temperature, Deg. Abs. Fahr. = °F. + 460.
k' and z are constants shown in the table below:

Group No.	Specific Gravity (Air = 1)	Max. Pressure When Temp. is Above 50°F. Lbs./Sq. In. Abs.	Constants in Equation k'	z
I	.55 to .60	up to 600	247800	2.021
II	.60 to .65	up to 600	332100	1.814
III	.65 to .80	300 to 600	433200	1.651
IV	.65 to .75	up to 300	499200	1.545
V	.75 to .90	up to 300	791000	1.263
VI	.90 to 1.1	up to 250	1162700	1.072
VII	1.1 to 1.5	200 to 100	1748200	0.903

Note: Use Group III for Gravities of .65 to .80 above 300 lbs./sq. in.


REFERENCE
C.N.G.A. BULLETIN TS-353.
$F_{G\cdot T\cdot PV}$
COMBINED CORRECTION FACTOR
SUPEREXPANSIBILITY FACTOR = √F
TEMPERATURE °F.
SPECIFIC GRAVITY (AIR = 1.00)
INSTRUCTIONS
SET THE INDEX LINE ON THE SPECIFIC GRAVITY WHICH APPEARS IN THE WINDOW. REVOLVE THE ROTOR UNTIL THE TEMPERATURE IS OPPOSITE THE SPECIFIC GRAVITY AND ON THE INDEX LINE. HOLDING THE ROTOR STATIONARY, SET THE INDEX LINE ON THE SUPEREXPANSIBILITY FACTOR. AND READ THE COMBINED CORRECTION FACTOR, $F_{G\cdot T\cdot PV}$, OPPOSITE THE SUPEREXPANSIBILITY FACTOR AND ON THE INDEX LINE.
EXAMPLE
S.G. = 0.714, TEMP. = 82°F., F_{pv} = 1.0343; $F_{G\cdot T\cdot PV}$ = 1.1990

—Copyright 1936, by W. E. Helmick

FIG. 2. Slide rule for the combined correction factors used in measuring natural gas with orifice meters.

P_s are the chart readings. Complete details of the foregoing will be found in C. N. G. A. Bulletin TS-353, "Tentative Standard Procedure for the Measurement of Natural Gas with Orifice Meters."

The Superexpansibility Factor Slide Rule

The superexpansibility factor slide rule illustrated in Fig. 1 is direct reading for the units generally used in the measurement of gas. It solves seven empirical equations which are shown on the face of the rule, and which are all of the same order but have different constants. The same proportioned logarithmic scales are used for compactness. It consists of the rotor, base, and index line. At first glance, the rule appears somewhat complicated; however, after the example and a few problems have been solved, it will be found easy to read and manipulate. Note that the specific gravity and temperature scales are inverted; i.e., they read from right to left. First determine the group number on the table shown on the rule from the observed specific gravity and line pressure, and locate this group number and the corresponding pressure window on the rotor. Then revolve the rotor until the pressure appears in the window. After setting the specific gravity opposite the pressure, read the superexpansibility factor opposite the temperature.

The slide rule will be mainly of use in the measurement of natural hydrocarbon gases under pressure with orifice meters, and it gives a simple and an accurate method of obtaining superexpansibility factors without intricate computations or interpolations of tables. These values may be used either when test data are not available on the particular gas to be metered, or when the accuracy of the measurement does not warrant running a deviation test. The results will be in close agreement with the final results of numerous tests compiled by the California Natural Gasoline Association in their Bulletin TS-354. The reader is referred to Part II of this bulletin in which the author shows the development of the empirical equations upon which the slide rule is based, together with other equations for interpolating test data, and for determination of the factor when small amounts of foreign gases are contained in the gas being metered.

Pressure-temperature-specific gravity conditions may exist that are not shown on the rule. Each of these scales was terminated at points wherein the gas was known to be in a state of equilibrium. The possible exceptions of Groups V, VI, and VII are pointed out because in these groups some condensation may occur at conditions of maximum pressure and specific gravity at minimum temperatures.

When the value of the superexpansibility factor F_{pv} is found to be less than 1.001, and it is required that greater accuracy must be obtained, the factor may be determined from slide rule readings in the following manner:

(a) Double the gauge pressure and convert to absolute pressure,
(b) From the slide rule find the factor using this pressure and the given specific gravity-temperature conditions,
(c) Subtract 1.0000,
(d) Divide by 2, and
(e) Add 1.0000 to obtain the desired result.

Example:

Assume SG = 0.636 (Group II), P_g = 10.14, and t = 90°F. Then, (a) 2 × 10.14 + 14.73 = 35.01; (b) from the slide rule F_{pv} = 1.00158; (c) 1.00158 — 1.0000 = 0.00158; (d) 0.00158/2 = 0.00079; (e) 0.0008 + 1.0000 = 1.0008.

The opposite of the foregoing method does not apply when the factor is found to be greater than 1.060; however, the following example illustrates the method for calculating the factor at conditions not shown on the slide rule:

Example:

Assume SG = 0.780, P_g = 580 (Group III), and t = 78° F. or T = 538° abs. F.

(Continued on Page 58)

S.C.M.A. Group Hears Relief Valve Topic

THE Christmas spirit was much in evidence as a capacity crowd of Southern California gas and oil men attended the December meeting of the Southern California Meter Association at the Van Matre Inn, Huntington Park, Calif. Guy Corfield, president of the association, presided.

A well balanced program was arranged by the Association's program chairman, R. F. Angell of the Union Oil Co. of Calif. Feature of the evening was the presentation of a thoroughgoing study on the "Installation and Maintenance of Relief Valves" by F. A. Hough, distribution engineer of the Southern Counties Gas Co., Los Angeles. Mr. Hough's paper is presented in full on Page 18 of this issue of *G A S*. Guest speaker for the evening was Richard Sneedon, editor of the *Union Oil Bulletin*. Mr. Sneedon added a distinct tone of lightness and gayety to the meeting.

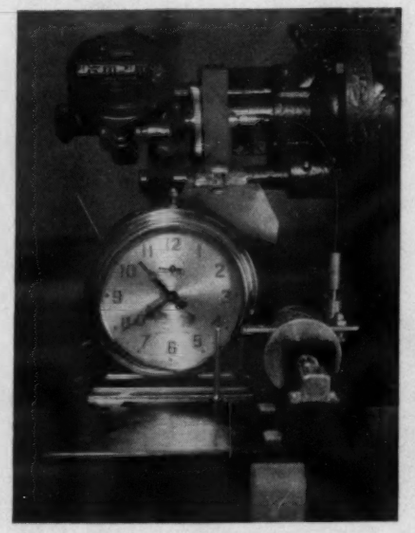
Throughout the dinner and following the meeting musical entertainment was furnished through the courtesy of the Crosby Steam Gage and Valve Co. with George Christen, manager of the company, acting as master of ceremonies. A $5 order for a Christmas turkey was given away at the meeting.

Automatic Device Reads Meters at Specific Time

By H. M. BROWN

Meter Supervisor, Public Service Co. of Northern Illinois

THE Public Service Co. of Northern Illinois was recently faced with the problem of obtaining accurate readings at a definite time on the meters of industrial customers who were supplied with natural gas. This problem became more acute as the number of this type of customer increased, but through the development of a simple mechanical device by its meter department, it is now possible to record the readings of these meters at any predetermined time.



The Automatic Meter Reader, adapted for use on either the Roots-Connersville Rotary or Meteric meters with only one change in connections, is designed with a set of gears which are reduced to the same ratio as the regular meter index. At any time on which the alarm is set, an arm automatically opens the clutch and releases the auxiliary counter without stopping the regular counter. Upon the arrival of the meter reader, he reads the auxiliary reader, sets up the reading shown on the regular counter, and trips the clutch in for the next 24 hours' reading.

The contract between the company supplying the natural gas and the Public Service Co. of Northern Illinois specifies that those industrial customers supplied with interruptible gas service shall have meter readings taken at 12:00 noon, daily. Inability on the part of the Public Service Co. to take these meter readings at the time specified may result in inaccuracy in the demand registrations.

The customers supplied with this type of service are scattered over a considerable area, including the cities of Ottawa, Streator, Marseilles, Chicago Heights and other widely separated communities.

Previous to the development of this automatic meter reading device, 12 men with cars were required to read the meters of the industrial customers. Providing no difficulties arose, these men were able to obtain the required readings by 1:00 p.m., each day.

With the present method, using the Automatic Meter Reader, only three men are required, and all readings are taken at the time specified. Naturally, with the number of men required to take these readings reduced, the costs of such operations were reduced.

■ ■

A.G.A.E.M. Appoints Committeemen To Serve With A.G.A. Group

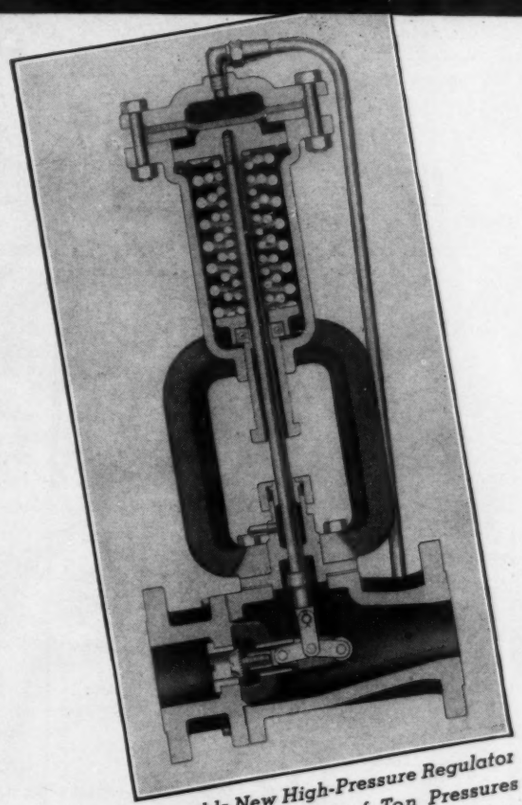
THE Association of Gas Appliance & Equipment Manufacturers has appointed three members to serve on the Committee on Domestic Gas Research of the American Gas Association, in accordance with a resolution passed at the 1936 A.G.A. convention. F. H. Adams has been appointed for a three-year term; Arthur Stockstrom for a two-year term; L. R. Mendleson for a one-year term.

Under the Association resolution which provides that the A.G.A.E.M. may appoint technical advisory committees to confer with the Committee on Domestic Gas Research, the following appointments are announced:

Domestic Gas Range Division: Arthur Stockstrom, chairman; W. T. Bradbury, W. H. Guenther, E. R. Guyer, and B. B. Kahn.

Gas Water Heater Division: E. J. Horton, chairman; Arthur Friedman, P. H. Hamilton, E. S. Hoyt, Jr., Chester L. Jones, and F. E. Wegener.

HIGH PRESSURE



Reynolds New High-Pressure Regulator for Safe Handling of Ton Pressures

SAFE AT A TON

REYNOLDS High Pressure Regulators for pressures of one ton on down provide ample safety factors. These factors, an all-important consideration in every high-pressure installation, are factory proven through a range of operating conditions more rigid than those met ordinarily in routine operation. Write for details.

BRANCH OFFICES:
421 Dwight Building
Kansas City, Missouri
2nd Unit, Santa Fe Bldg.
Dallas, Texas

REPRESENTATIVES:
Eastern Appliance Co.
Boston, Mass.
F. E. Newberry
Avon, New Jersey

GAS CONTROL SINCE 1892

REYNOLDS GAS REGULATOR CO.
ANDERSON, INDIANA, U. S. A.

COOPERATIVE LOAD BUILDING P.C.G.A. BULLETINS

COMMITTEE
A. C. JOY (P. G. & E.)
Chairman
J. S. SPAULDING
(L. A. G. & E.)
FORREST RAYMOND
(San Diego Cons.
G. & E. Co.)

COMMITTEE
DOUGLAS BUCKLER
Southern California
Gas Company
CLIFFORD JOHNSTONE
Managing Director
Pacific Coast Gas
Association

Enlarged Campaign 9th Consecutive Year

Plans of the Cooperative Advertising Committee, Pacific Coast Gas Association, for an enlarged campaign during 1937 have been approved by Gas Company executives. Again, appliance manufacturers and dealers will have the added support of this regional advertising without one cent of cost to them. 1937 will mark the ninth consecutive year of this campaign—a record unequalled in the gas industry, exceeded in few if any other industries.

A. C. Joy
Chairman

Posed by members of the famous "Jones Family" cast (20th Century-Fox Productions), which includes . . . Shirley Deane, Dixie Dunbar, June Carlson, Ted Healy, Spring Byington, and Kenneth Howell. See their current hit: "Off to the Races."

FATHER should provide two bathrooms! Even then, his big family would have plenty of hot water—thanks to an AUTOMATIC GAS WATER HEATER wisely selected with ample capacity for peak demands. Generous in service, thrifty in operation, the GAS AUTOMATIC "always delivers" at a faucet's turn—dependable as your gas service itself—giving *convenience* a new dimension, *comfort* a brighter smile.

Your home needs hot water—for bathing, shaving, laundry, cooking, dishes—as many as 150 times a day. A GAS AUTOMATIC supplies hot water for an entire family's tub baths, or a large weekly washing, at an average fuel cost near the price of an ice cream cone. See new *storage* and *instantaneous* models displayed by your Gas Company or Appliance Dealer. Budget-fitting terms, of course.

WATER HEATING • COOKIN[illegible]NG • REFRIGERATION

The Pacific Coast Gas Association, Inc. G[illegible] of which your Gas Company is a member

Gas THE MODERN FUEL

TRADE JOURNALS

Full-page and ⅔-page ads will appear in:

CALIFORNIA, MAGAZINE OF PACIFIC BUSINESS
ARCHITECT & ENGINEER
CALIF. ARTS & ARCHITECTURE
WESTERN MACHINERY & STEEL WORLD
WESTERN BAKER & PACIFIC BAKER
PAC. LAUNDRY JOURNAL & DRY CLEANER
WESTERN CONFECTIONER & ICE CREAM NEWS
PAC. COAST RECORD & WESTERN RESTAURANT
KEELER'S PACIFIC HOTEL REVIEW
WESTERN HOTEL REPORTER
WESTERN BEAUTY SHOP
WESTERN FURNITURE RETAILING
WESTERN PLUMBING & HEATING JOURNAL
BUILDING STANDARDS MONTHLY

News Flash!

DOMESTIC ADVERTISING

"The Jones Family" of movie fame (Twentieth Century-Fox) will participate in this year's domestic consumer advertising. See proof of the January full page ad, in reduced size, posted here. It will appear in:

SUNSET • CALIFORNIA HOMES
CALIFORNIA PARENT-TEACHER
CALIFORNIA FEDERATION NEWS
PARENT-TEACHER JOURNAL
PARENT-TEACHER COURIER

P. C. G. A. Technical Section Groups Inaugurate Varied Activities

STUDIES on soil testing, cellulose wrappings, and electrolysis are being prepared by the subcommittee on pipe protection of the Transmission Committee, Pacific Coast Gas Association, Technical Section. H. G. Laub, Southern California Gas Co., is chairman of the subcommittee. Serving with him are M. T. Burton, D. R. Hiskey, and J. B. Reddick, all of Southern California Gas Co.; C. P. de Jonge, San Diego Consolidated Gas & Electric Co., and W. R. Schneider, Pacific Gas and Electric Co.

The subcommittee on compressor plants will make studies of pressure drop in station piping, jacket water and lubricating oil requirements, the new overspeed control, and gas holder maintenance. H. J. Smith, Pacific Gas & Electric Co., is chairman of this subcommittee. Other members are Leal Davis, A. L. Hill, Byron Milner, O. A. Philpott, all of Pacific Gas & Electric Co.; E. V. Stone, of Safety Instruments, and T. C. Wallace, of Southern Counties Gas Co.

A. B. Allyne, Southern Counties Gas Co., is chairman of the Transmission Committee under which these subcommittees are functioning.

The P.C.G.A Distribution Committee of which Frank Pape, Pacific Gas and Electric Co., is chairman, has three subcommittees conducting important studies. Under Chairman F. A. Hough, Southern Counties Gas Co., a subcommittee is continuing the study of unaccounted-for gas, which Mr. Hough started last year. Committee members are A. R. Bailey, Coast Counties Gas & Electric Co.; R. S. Fuller, Pacific Gas & Electric Co.; E. Henderson, Southern California Gas Co.; W. M. Henderson and Norman Hoff, Los Angeles Gas & Electric Corp.

The subcommittee on measurement and regulation, whose chairman is Henry Harris, Los Angeles Gas & Electric Corp., is carrying out studies on meter-proving conditions and remote control of regulator stations. Other members of the committee are C. W. Capwell, San Diego Consolidated Gas & Electric Co.; J. J. Egginton, British Columbia Electric Power & Gas Co., Ltd.; Harry Faull and F. H. Winslow, Southern Counties Gas Co.; W. A. LaViolette and R. M. Stuart, Pacific Gas & Electric Co.

The subcommittee on construction and maintenance of distribution structures is compiling data from the experience and methods developed in this field by members. Special attention will be paid to welding and the location of underground structures.

A.G.A. Issues Book Comparing Gas and Electricity

A 36-page booklet, "Reprints of Articles Covering Use of Gas and Electricity for Domestic Cooking and Heating Purposes," has been issued by the Testing Laboratories of the American Gas Association. This booklet, a compilation of five previously published articles, deals with the comparative performance of gas and electric household appliances. More than 5,000 copies have been distributed to gas companies, appliance manufacturers, retailers, colleges and universities, scientific foundations, libraries, and many others during the past two months.

From the material presented, the comparative operating costs of gas and electric ranges, refrigerators, water heaters, and space heaters in any locality in the nation can be determined.

It is believed that this booklet will be of value to every gas appliance salesman, and to others concerned with the domestic cooking and heating problem as it relates to gas and electric appliances. Copies of this publication may be obtained at the American Gas Association Testing Laboratories, Cleveland, Ohio, at the following prices: First 25 copies, 25 cents each; additional copies, 20 cents each.

■ ■

Midwest Industrial Sales Group Meets Jan. 22

THE Midwest Industrial Gas Sales Council of the American Gas Association will convene on January 22 at the Palmer House, Chicago, Illinois. C. G. Callow, sales manager, refrigeration division of the Waukesha Motors Co., will give an address at the morning session on "Automatic Gas Engines for Power." He will discuss the use of gas for power production and the use of gas engines in connection with air conditioning.

Speakers at the afternoon session will include Nathan Schofer, Illinois Northern Utilities Co., Dixon, who will talk on "Selling High Priced Gas to Industry"; and James Dare, Public Service Co. of Northern Illinois, Harvey, who will address the group on "Converting Oil Car Type Annealing Furnaces to Gas."

■ ■

Reynolds Names P.C.G.A. Sales, Advertising Section

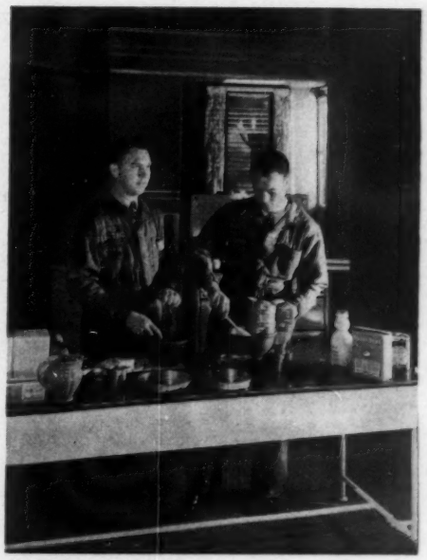
B. W. REYNOLDS, chairman of the Sales and Advertising section of the Pacific Coast Gas Association, has appointed the following members to head committees under his section:

M. O. Pratt, domestic sales manager of the Seattle Gas Co., chairman of the Domestic Sales Committee; R. T. Stephens, supervisor of industrial sales, San Francisco division, Pacific Gas & Electric Co., chairman of the Industrial Sales Committee; J. S. Spaulding, advertising manager, Los Angeles Gas & Electric Corp., chairman of the Advertising Committee; Gladys Price, home service director, Southern California Gas Co., chairman of the Home Service Committee.

■ ■

Midwest Sales Conference Meets in February

The 1937 conference of the Midwest Sales Council will be held February 18-20 at the Palmer House in Chicago. The definite date for the annual conference was established at a meeting of representatives of midwestern utilities held in Chicago recently. The convention sessions will be held in the Red Lacquer room of the hotel.



Cooking Service Men Concoct Cakes at Pasadena School

CAKE-BAKING service men featured a unique and well-received cooking school series sponsored in Pasadena, Calif., during November and December by the Los Angeles Gas & Electric Corp. and the Pasadena *Independent*. Victoria Warner, home economist of the Los Angeles utility, directed the schools.

The cooking class was conducted by two members of the utility's service department, Harry Booth and Larry Brady, whose cooking ability, besides amusing the attending housewives, convinced them that members of the company's service department were capable not only of adjusting appliances, but also of giving practical cooking demonstrations in answering questions on how to use modern gas appliances to get the best cooking results. The illustration shows Harry (left) and Larry (right) in the act of baking a cake at the school.

Through their knowledge of the finer features of gas appliances and through their ability to perform cooking demonstrations for housewives, the service men of the company have been able to disseminate knowledge and clarify many points on the clock control and temperature control features of the range and on the advantages of low temperature cooking.

■ ■

Frank Moon to Revise P.C.G.A. Gas Fuel Data Book

Guy Corfield, chairman of the Utilization Committee of the Pacific Coast Gas Association's Technical Section, has appointed Frank Moon, Los Angeles Gas & Electric Corp., as chairman of a committee to revise and add to the Association's "Data Book on Gas Fuel." This booklet was first published in 1931 and at that time was written by a committee headed by Mr. Moon in cooperation with Albert John Evers, prominent San Francisco architect. Written primarily for architects and builders, it proved of much value to the Pacific Coast building industry. The resumption of large scale building operations has led to a demand for a second edition.

So. Calif. Gas Co. Opens Branches

EXPANSION activities of the Southern California Gas Co., Los Angeles, Calif., include the recent establishment of two branch offices and the planning of two additional, according to word received from F. J. Schafer, vice-president in charge of manufacture and distribution.

Opened late in November was the company's new branch office in Westwood, Los

Angeles residential suburb and home of the University of California at Los Angeles. The new building follows the ultra modern architecture characteristic of the community. The front is finished in blue enamel on steel, with a metal backed neon sign which reads, "Cook, Heat, and Freeze, with Natural Gas." The show room of the office features displays of modern gas appliances and a model kitchen. A. L. Lynch, the company's Beverly Hills agent, officiated at the opening day ceremonies.

A second branch office will soon be opened in Palm Springs, famous California winter resort. Architectural style of the building conforms to the type prevalent in the community, being of approved hollow concrete tile construction. Two cottages to house the members of the local staff have also been built.

Plans for two additional branch offices to serve Tulare and Hemet, Calif., district are going forward rapidly.

■ ■

Eleven Utilities Boast Clean Safety Records for 1936

ELEVEN out of 139 public utility companies and units entered in the Public Utilities Annual Safety contest went through the year ending June 30, with perfect no-accident records, according to an announcement made by the 25th National Safety Congress and Exposition, which convened recently in Atlantic City, where group winners received awards. Following are the awards:

Combination gas and electric division, Group A: (1) Central Illinois Light Co., Peoria, Ill.; (2) Virginia Electric & Power Co., Richmond, Va.; and (3) Georgia Power Co., Atlanta, Ga.

Combination gas and electric division, Group B: Tied for first award were Suburban Gas & Electric Co., Revere, Mass.; Michigan Gas & Electrical Co., Ashland, Wis.; and Moncton Electricity & Gas Co., Ltd., Moncton, N. B., Canada.

Gas division, Group A: (1) Hope Natural Gas Co., Pittsburgh, Pa.; (2) Peoples & Columbia Natural Gas Cos., Pittsburgh, Pa.; and (3) Columbia Gas & Electric Corp., Columbus, Ohio.

Gas division, Group B: (1) Northwest Cities Gas Co., Walla Walla, Wash.; (2) St. Louis County Gas Co., St. Louis, Mo.; and (3) New Haven Gas Light Co., New Haven, Conn.

■ ■

S. R. Dresser Co. Announces New Pipe Repair Sleeves

THE S. R. Dresser Manufacturing Co. of Bradford, Pa., has introduced a new type of sleeve, known as the Dresser Split Sleeve. These sleeves are designed to allow full or partial service to continue while the

repair is being made, being useful in effecting a complete and permanent repair of any split, break or hole in any type of pipe line.

The sleeves can be installed under water if necessary. One tool only is needed, a wrench. Two or more sleeves can be joined together in a multiple installation to cover breaks that are longer than 8-inches.

The accompanying illustrations show how a break in a 4-inch pipe was repaired with a Dresser Style 57 Split Sleeve.

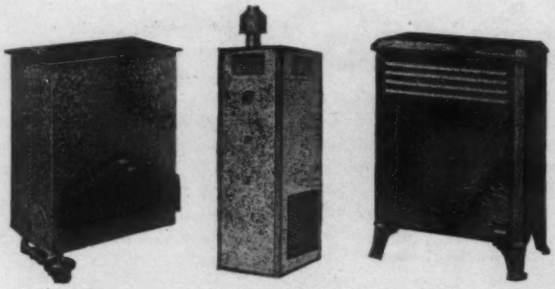
■ ■

Gas Service Co. Brings Gas To Higginsville, Mo.

On December 16, just 36 days after voters of Higginsville, Mo., granted the Gas Service Co., Kansas City, a franchise, natural gas was turned into the northern half of the city's new distribution system. Construction of the remaining half of the distribution system is going forward under the direction of Joe Schubert, manager of the company's Warrenburg division. Gas for the community is being brought from the Amarillo fields in Texas.

Early in December reports revealed that 80 customers had already signed contracts for the service and that 35 of this number had been installed.

GET "SET"
for 1937



Floor Furnace Forced-Air Thermolator

Never since gas became the nation's most popular fuel has it been so imperative for utilities and dealers to recommend and install the proper appliances—assure complete consumer satisfaction, to gain freedom from troublesome service details! Pacific makes a Gas Heating Appliance for every need—all exceptional heating values. Don't wait—investigate NOW!

Ask for complete catalog.

PACIFIC GAS RADIATOR COMPANY
Huntington Park, California

PACIFIC
Gas Heating Appliances

REDUCED GAS RATES
GAS BILL
Cut HEATING COS
HEATING COST CALCULATOR
Figure it out for yourself
20,000 A. G. A. INPUT RATING
$1.20 HOURLY OPERATING COST
$1.06 HOURLY OPERATING COST
$ .90 HOURLY OPERATING COST
New Reduced Gas Rates Save You Money

MADE 'SPECIALLY FOR RETAIL APPLIANCE DEALERS

WHAT IT IS: A vest pocket manual of information on gas heating and water heating **plus** a handy calculator of operating costs.

HOW IT WORKS: Each page is given to one particular type of appliance—a picture and a brief explanation of what the appliance is and what it will do.

THE CALCULATOR is built into the back cover. The cover is double with four little windows punched in one end. Inside is a printed card. The card is set by sliding it in or out until the figure in the top window corresponds with the A. G. A. rating of the appliance. This done, the figures in the lower windows will show the **maximum** hourly operating cost.

OBVIOUSLY this little device is a selling tool. It supplies a quick, positive answer to any question about operating cost. It explains "B. T. U."—gets the customer to think in terms of heat-units-per-dollar. It shows heating, cooking and water heating to be separate and distinct services, even though billed as one. In short, it sells the economy of gas fuel—helps you sell the appliances. Every customer, whether he buys or not, should take one of these booklets away with him.

ORDER A SUPPLY FOR CUSTOMER DISTRIBUTION . . . . TODAY!

P·G·and E·

PACIFIC GAS AND ELECTRIC COMPANY

Owned · Operated · Managed by Californians

G 201-137

Survey Shows Window Display Strong Sales Factor

FURTHER proof of the sales value of a satisfied clientele and attractive show windows were brought to light in a recent extensive survey by a large manufacturing concern. Object of the survey was to determine what factors influenced people to enter a store and what was the relative importance of these factors.

Customers asked "Why did you come in" answered in the following manner:

Recommended by satisfied customer	41.0%
Show window display	24.0%
Permanent patrons	20.0%
Newspaper advertising	11.5%
Sent by other firms	3.0%
Miscellaneous	.5%

While the recommendation of satisfied customers stands as the most important factor, the survey revealed that many of the recommending customers were probably first attracted to the store through its window displays. Still another interesting fact regarding the effectiveness of window displays was advanced when it was found that of 1,000 persons interviewed, 70 to 75 per cent were sufficiently impressed by the window display to be able to name the article shown.

■ ■

Famous Chefs Demonstrate For Peoples Gas Light Guests

Famous chefs of three Chicago hotels demonstrated secrets of their craft before guests of the Peoples Gas Light & Coke Co., Chicago, Ill., at the first of a series of entertainments that the company will offer Chicago women under the direction of Miss Karen Fladoes, new home service director.

Cyrielle Dumuyt, pastry chef at the Stevens Hotel, made spun-sugar flowers and baskets. Charles Graf, chef at the Blackstone, decorated a big birthday cake. Jack Regoni, chef at the Auditorium Hotel, made a "Baked Alaska."

■ ■

Iroquois Gas Co. Authorized To Reduce Rates in N. Y. Area

The New York Public Service Commission has authorized the Iroquois Gas Co. of Albany to reduce its rates in Buffalo, Lackawanna and numerous towns and villages in Erie, Cattaraugus and Wyoming counties. Effective December 10, the reductions apply to the use of more than 10,000 cubic feet per month for industrial, domestic, and residential purposes. The rate in Buffalo is now 65 cents per month per 1,000 feet for the first 10,000; 60 cents for the next 15,000 and 55 cents for all in excess of 25,000.

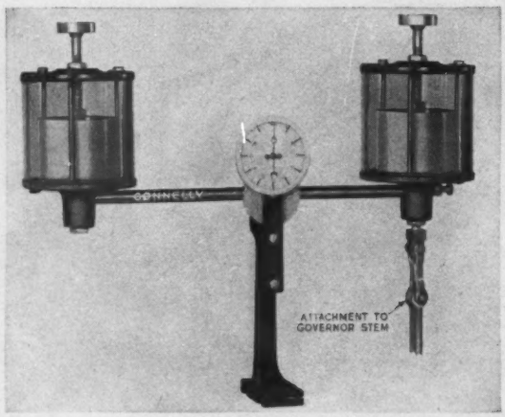
■ ■

Tri-County Gas Appoints Fowlston Superintendent

Tri-County Gas Co., Kansas, has appointed C. J. Fowlston of Amarillo, Texas, as superintendent. The company serves Scott City, Lakin, Deerfield, and adjacent Kansas territory. Mr. Fowlston's headquarters will be at Scott City.

AT LAST—The Smyly Mercury Loader

a simple fool-proof substitute for the old style Connelly mercury loader. Can be used on float or diaphragm governors for Station or District use.



Without any complicated or perishable moving parts. Adjustment very flexible to meet local conditions.

●

Write for Bulletin 200 B-2 for complete information.

Connelly
Iron Sponge & Governor Co.
Chicago, Ill. Elizabeth, N.J.

Use of the Slide Rule In Gas Measurement

(Continued from Page 52)

Since Y equals F^s_{pv}, the equations on the slide rule may be solved by the logarithmic equation:

$$\log (Y-1) = \log P_g + \log k' + Z \times SG - 3.825 \log T \quad (3)$$

then

$$\begin{aligned} \log 580 &= 12.76343-10 \\ \log 433200 &= 5.63670 \\ 1.651 \times 0.780 &= 1.28778 \\ -3.825 \times \log 538 &= -10.44523 \\ \log (Y-1) &= 9.24268-10 \\ Y-1 &= 0.17486 \\ Y &= 1.17486 \\ F_{pv} &= \sqrt{1.17486} \\ &= 1.0839 \end{aligned}$$

These equations may be used to interpolate test data for conditions of temperature, pressure, or specific gravity by calculations similar to the above. Because the values shown of Z and k' are contiguous, they shall not be interpolated. For example, should the specific gravity change from 0.657 to 0.631, the average would be 0.644 and hence the value of Z would be taken at 1.814, and k' at 332,100.

Note: The use of this rule for gas orifice meter computations has been approved by the C.N.G.A. Technical Committee.

The Combined Correction Factor Slide Rule

The foregoing equation (2) may be simplified for the purpose of saving time in routine chart computation work when steady conditions exist in the specific gravity, temperature, pressure, and rate, by combining several or all of the factors into one correction factor. This factor, which is the product of all the factors combined, is then multiplied by the unit gas coefficient C to obtain the unit gas coefficient C^1 adjusted for actual conditions of the flowing gas.

Combining the correction factors for specific gravity, temperature, and superexpansibility gives

$$F_{g,t,pv} = \sqrt{\frac{1}{G}} \times \sqrt{\frac{520}{460 + °F.}} \times F_{pv} \quad (4)$$

The special slide rule offers the most practical method of solving this equation quickly and accurately, and it is based on the logarithmic equation:

$$\log F_{g,t,pv} = \log F_{pv} + \tfrac{1}{2} \log 520 - \tfrac{1}{2} [\log G + \log (460 + °F.)]$$

Fig. 2 illustrates the combined factor slide rule, which is also direct reading. As definite limits may be fixed for the usual values of the specific gravity, temperature, and superexpansibility factors, the limits of the combined factor may be established. The scales of the slide rule need not cover more than these limits and therefore they may be made any reasonable length to provide the

required accuracy of four places behind the decimal point. The result is obtained with two settings of the rule when an invert scale is used in either the specific gravity or the temperature scales. This method simplifies setting the rule as the temperature is set opposite the specific gravity, and it allows a direct check of the readings before proceeding with the F_{pv} multiplication.

It is desirable to combine the factors F_e and F_r with the foregoing, and this could be accomplished by adding their logarithms to the equation, which would require two additional settings and would complicate the slide rule. There is a shorter method of performing these multiplications.

Inspection of the values assigned the factors F_e and F_r shows that only in exceptional cases do they exceed 1.0080. The product of two similar numbers may be expressed as

$$(1+A)\ (1+B) = 1+A+B+AB$$

where A and B represent the figures behind the decimal points. Now, if the result is corrected to four places behind the decimal point, and A × B is less than 0.00005, then

$$F_{e.r} = (1+A)\ (1+B) = 1+A+B \quad \text{.....(5)}$$

Visual inspection of the values F_e and F_r is usually all that is necessary to determine if equation (5) may be applied in combining these factors. Thus, one step and one setting of the slide rule is eliminated when combining all five factors to obtain the factor F'.

The logarithmic scales of the factors F', F_{pv}, F_e, and F_r are the same numerically, and therefore the F_{pv} scale of the slide rule may be used to multiply the factor $F_{g.t.pv}$ by $F_{e.r}$ in the following manner:

First determine the combined correction factor $F_{g.t.pv}$ as shown in the instructions on the rotor of the slide rule. Then determine the factors F_e and F_r from tables and methods presented in C.N.G.A. Bulletin TS-353. To 1.0000, add the figures behind the decimal points of these two factors (provided the product of the latter figures is less than 0.00005) to obtain the combined correction factor $F_{e.r}$. Holding the *index line* of the slide rule on the predetermined $F_{g.t.pv}$ *factor,* revolve the rotor until the figure 1.00 (read on the superexpansibility factor scale) appears opposite the *index line.* Holding the rotor stationary, set the *index line on the* $F_{e.r}$ *factor,* which is also read on the superexpansibility factor scale. The *combined correction factor* F' is then read opposite the $F_{e.r}$ *factor* and on the *index line.*

Example:

Let G = 0.714, Temp. = 82°F., F_{pv}=1.0343
Then $F_{g.t.pv}$ = 1.1990 (from the slide rule)
F_e = 1.0041, and F_r = 1.0009,
(By inspection, .0041 × .0009 is less than 0.00005) and $F_{e.r}$ = 1.0000 + .0041 + .0009 = 1.0050

Multiplying 1.1990 by 1.0050 on the slide rule gives F' = 1.2050.

Using the combined correction factor, equation (2) becomes

$$Q = C \times F' \sqrt{h \times P} \quad \text{.....(6)}$$

and for square root charts

$$Q = C \times F' \times M \times h_s \times P_s$$

PARKHILL-WADE, INC.

CONSULTING and CONSTRUCTION ENGINEERS

973 No. Main Street, Los Angeles, Calif.

Affiliated with The Stearns-Roger Manufacturing Co. in the design and construction of

Gas Dehydration Units with Calcium Chloride, Glycerine or Diethylene Glycol Cycles

Natural Gasoline Plants Dust and Liquid Scrubbers

Stabilization Plants Butane Production Units

Butane Storage and Handling Equipment

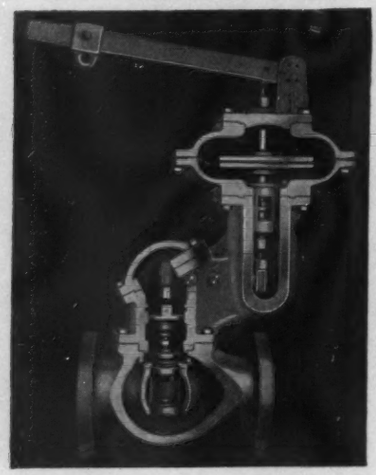
Pull... Turn... Push...

. . . the knob and this new temperature relief valve is ready to operate again. No parts of any kind to replace!

Install it ahead of the thermostat and it prevents over-heating by shutting off the gas supply when the danger point is approached. Gas men and water heater manufacturers are invited to write for particulars.

DOMESTIC MANUFACTURING COMPANY

700 East Slauson Ave. Los Angeles, Calif.



New CBV Types Announced By Reliance Regulator

RELIANCE Regulator Corp., division of American Meter Co., announces a new line of gas regulators featuring an improved combination balanced valve (CBV) unit. The new line offers such advantages as interchangeability of parts, unit construction, reduced motion and friction, and greater accuracy in regulator control.

A full range is presented of lever weighted, spring loaded and pilot models of both offset and direct connected types; either reducing or back pressure regulators, affording many different combinations in assembly. Standard sizes from the straight 2- up to 10-inch will be available; the smallest orifice throat being 1¼-inch in diameter. All bodies are the same, for high or low pressure service.

For convenience, the regulators are designated as the high pressure type of units. The only differentiation for low pressure construction is where semi-low or low-pressure enclosed dead weight diaphragm head exists and where bearing pins are installed so as to give a 3.4 to 1 lever pressure, as compared with pin installations in the center hole to produce a 1 to 1 power ratio for the high pressure units. Change from high to low pressure service is easily effected.

A special stabilizer eliminates surging and pulsation. The offset types have the rocker arm, equipped with oilite bushings and stainless steel rockers.

All diaphragm heads are interchangeable on any size, of both offset and direct connected types, only three different sizes of bolt and cap screws being used. Upper diaphragm chamber cover plates are interchangeable.

Offset type units connected on the 1 to 1 power ratio, have the same power as the direct connected units. Valve stem, valves, cage, etc., may be removed as a single unit.

All valve stems are of stainless steel, with forged steel valve seats, bronze guides and cast iron cage. Gasketed surfaces are recessed and grooved.

■ ■

Wilcolator Names Mauer to Chicago Vice-presidency

THE Wilcolator Co. of Newark, N. J., announces the appointment of Rufus H. Maurer as a vice-president of the company.

Mr. Maurer is well known in the temperature control industry for his success with the Spencer Thermostat Co. Closely identified with the gas industry for many years, he was one of the original members of the utilization department of the Consolidated Gas Co. of New York, and as illuminating engineer, was special representative to the Illuminating Engineering Society as well as a member of the Society of Gas Engineers of New York City and the American Gas Association. As president of the Automatic Safety Pilot Corp. of New York, he was the builder of the first safety pilot for gas appliances in this country.

Mr. Maurer will make his headquarters in Chicago and will handle the sale of Wilcolator products in the Middle Western district.

■ ■

American Radiator Offers New Radiator Enclosure

The American Radiator Co., New York, N. Y., announces a new circular enclosure for convector radiators in apartment houses. The new feature makes it possible to conceal the radiator, providing warmth with improved appearance and the saving of valuable floor space. The newest style Arco Radiant Convector provides two kinds of heat—sun-like radiant heat and heated air. Radiant heat provides warmth in spite of drafts or air motion.

Arco Enclosures have been installed in the Chrysler building, the Empire State building, Cities Service building, the Bronx County Court House, and in Radio City in Rockefeller Center.

AIR CONDITIONING
Electrogas
HEATING EQUIPMENT
FURNACES BLOWERS FILTERS WASHERS
Write for attractive Dealer proposition
ELECTROGAS FURNACE & MANUFACTURING CO.
2575 Bayshore Boulevard, San Francisco

New Mercedes Fuel Co. Line Brings Gas to Texas Valley

Industries and domestic gas consumers of the lower Rio Grande Valley, Texas, will be able to burn some of the valley's own gas with the recent completion by the Mercedes Fuel Co. of a 6-inch welded line from the Mercedes deep pool to the main line of the Rio Grande Valley Gas Company, a distance of 6 miles. The 6-mile line cost about $25,000 and has a daily capacity of 3,000,000 cubic feet.

Gas engineers say that the valley should have a continuous natural gas supply, since the trunk line supplying valley cities runs near more than a dozen different gas-producing fields.

The Union Sulphur Co. has completed a natural gas-gathering system in the Mercedes deep pool field to feed into the Mercedes Fuel Co.'s line.

■ ■

Southern Ontario Co. to Build Purification Plant

The Koppers Co., Pittsburgh, Pa., has been awarded the contract for a $125,000 natural gas purification plant by the Southern Ontario Gas Co. of Buffalo, N. Y. The Brownsville field is the site of the new plant. It is estimated that the unit will handle the entire output of the field, which has 14 wells with a potential open flow of approximately 20,000,000 feet a day. Completion of the plant is expected by January 31.

Gas will be delivered to the Southern Ontario Gas Co. via Highway 19, over which 20 miles of transmission line will be laid. Pipe has already been purchased for the line, and its completion is also expected early in 1937.

■ ■

So. Calif. Companies Pipe Gas From Ten Sections Field

The Industrial Fuel Supply Co., Los Angeles, has completed a seven and a half-mile, 16-inch main to bring casinghead gas from the Shell Co.'s plant in the new Ten Sections field in Kern county, to the Buena Vista Lake field. At this point the new line ties into a 10-inch line connecting with the Southern Fuel Company's 26-inch Kettleman Hills-Los Angeles main and an 8-mile, 12-inch line just completed by the Southern California Gas Co. This latter line connects with the two 12-inch mains of the Southern California Gas Co., which run from compressor station No. 40 at Taft to the Los Angeles metropolitan area.

■ ■

T. V. A. Extension Restrained By District Court

The Tennessee Valley Authority, spreading over 40,000 square miles, was last month enjoined from further expansion by an order signed by U. S. District Judge Gore. The injunction, won by 19 private utilities which claim capital investments aggregating $900,000,000, will prevent further expansion of T.V.A. until constitutionality of the program is determined in a separate hearing before Judge Gore March 8. The ruling will freeze activities of the T.V.A. in their status as of Aug. 20, prohibiting further solicitation of municipalities as consumers for power generated by T.V.A.

PERFORMANCE *measures the value of* BLAW-KNOX GAS CLEANERS

Reduction of Customer Complaints due to dust picked up by gas

"Availability" of Compressors during Peak Loads

Freedom from Dust Deposits on Compressor Valves

Lower Pump Station Upkeep Costs

Fourteen repeat orders from a large transmission system, totaling twenty-six units—indicate a definite confidence in the ability of Blaw-Knox Gas Cleaners to eliminate dust troubles, to reduce maintenance costs, and to maintain public relations.

This large transmission system (name on request) has invested in Blaw-Knox Gas Cleaners as follows:

Number of orders—14
Total number of units—26
First purchase—August 22nd, 1930
Last purchase—August 19th, 1935
Maximum working pressure—450# Ga.
Combined capacity—31,595,000 cf. hr. at 150# Ga. or
59,823,000 cf. hr. at 350# Ga.

This record of purchases indicates satisfaction with results from the equipment and an appreciation of the importance of the *protection* and *transportation cost reduction* afforded by Blaw-Knox Gas Cleaners.

Blaw-Knox Gas Cleaners are fully engineered, reliable and efficient, backed by a manufacturer who accepts the responsibility for meeting your conditions and fulfilling all performance claims. Full information about Blaw-Knox Gas Cleaners, large or small, is yours for the asking.

BLAW-KNOX COMPANY

2033 FARMERS BANK BUILDING - PITTSBURGH, PA.

Offices in Principal Cities

GREENLEE

Here is the Solution to Your Pipe Pushing Problems

Hydraulic PIPE PUSHER

One man, standing in a comfortable position, can exert a pressure of 40,000 pounds on the pipe clamp.

Here is a real improved pipe pusher that permits one man to stand in a comfortable position and send pipe where it is wanted, simply by pumping the handles. It is compactly built, easy to handle and simple to set up and operate. Because of its time and labor-saving features, it is often able to pay for itself on the very first job.

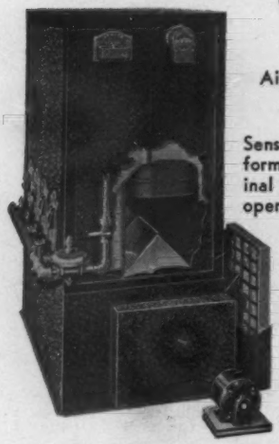
The Greenlee Hydraulic Pipe Pusher is self-contained. It operates on a notched steel base, which permits making a push of from 4 to 7 feet, depending on the length of base used, without changing the pipe clamp. When it reaches the front end of the base, it is pushed back to the opposite end, and the quick-acting clamp is then reset. Pumping the handles sets up a pressure within two oil cylinders to push the pipe. This provides a smooth-acting, powerful mechanism that is flexible and exceptionally simple. It will push pipe up to 4-inch, has eight speeds for varying soil conditions and will exert a maximum pressure of 40,000 pounds on the pipe clamp.

WRITE TODAY for COMPLETE DETAILS

GREENLEE TOOL CO., 1700 Columbia Ave., ROCKFORD, ILLINOIS

NEW LOW COST

FRASER



Gas Furnace and Winter Air Conditioning System

Sensational in performance, low original cost and low operating cost.

Write for details today.

Manufactured by

Fraser Furnace Company

Stockton, Calif.

Distributed by

H. R. Basford Company

San Francisco **Los Angeles**

An Extreme Service Test

Salt crystallized over the NO-OX-ID coating this brine tank. A screw driver chipped out a big flake and the NO-OX-ID beneath showed a shiny black unbroken surface, true to its trust of protecting the steel. Service tests of this type explain why NO-OX-ID is used so extensively for protection of gas holders, gas lines and auxiliary equipment. Inquiries invited.

DEARBORN CHEMICAL COMPANY

Los Angeles: 807 Mateo Street, Phone TRinity 3385

San Francisco: 421 Bryant St., Phone SUtter 8683

NO-OX-ID IRON RUST

The Original Rust Preventive

Public Utility Engineering Announces Appointments

HENRY C. CUMMINS, vice-president in charge of operation and engineering of Public Utility Engineering and Service Corp., announces the following appointments and changes in title among executives in the operating and engineering department of the organization:

E. D. Uhlendorf, executive engineer; F. H. Lane, manager, engineering division; A. H. Kuhn, manager, valuation division; G. E. Potter, assistant to executive engineer; W. B. Rittenhouse, assistant to manager, engineering division; W. C. Drummond, power production engineer; H. W. Eales, chief electrical engineer; H. S. Whiton, chief mechanical engineer; H. G. Robey, chief hydraulic engineer; L. J. Willien, chief gas engineer; W. J. Welch, chief design engineer; Stephen Wehner, hydraulic engineer; D. C. Hormell, mechanical engineer; H. O. Mathews, automotive engineer; J. A. Agee, budget control engineer.

■ ■

Ohio Oil Co. Lays 22-Mile Gas Line to Craig, Colo.

Laying 22 miles of 3-inch pipe in 20 days, the Ohio Oil Co., Findlay, Ohio, has completed a line from its Wymore well on the Thornburg structure, to Craig, Colo. Construction was undertaken when it was learned that the supply of gas from the Craig Dome, three miles west of Craig, was nearly gone. Craig lines have already been connected to the new line.

The Wymore well capacity is set at 30,000,000 cubic feet daily, under rock pressure of 700 pounds. It is estimated that the supply is sufficient to serve Craig for 50 years.

The pipe was laid in 40-foot sections. As neither teams nor tractors could get into the mountainous region between the Thornburg Dome and Craig, the pipe was placed by men.

■ ■

Vicksburg, Miss., to Build Gas Line to Jackson

The city of Vicksburg, Miss., has awarded the contract for a 44-mile, 6⅝-inch, lindewelded natural gas line, to the B. & M. Construction Co., of Oklahoma City. Jackson and Vicksburg will be the terminal points.

The Mississippi State Mineral Lease Commission, on December 11 refused Vicksburg a petition for a gas and oil lease on the state-owned lands in the Jackson gas field from which the city could develop its own gas supply.

The Commission announced that it would adhere to its present contract under which the state had agreed to either lease the city 320 acres in the gas field, or sell the city the production needed from state-owned and operated wells.

■ ■

U. S. Mayors To Investigate Marketing of Natural Gas

The United States Conference of mayors last month named a special committee to probe problems affecting the marketing of natural gas throughout the country, according to news dispatches. Appointment of the committee comes as the culmination of a resolution adopted by the mayors at a conference held in Washington late in November. It will be the duty of the committee to investigate all problems concerning the general subject of securing natural gas service for cities under reasonable rates.

Named to the committee were John W. Smith, president of the Detroit City Council, chairman; Herman C. Wenzel, commissioner of New York City public utilities; William J. Swoboda, mayor of Racine, Wis.; John Q. Carey, vice-mayor of Toledo, and William C. Reed, chairman of the Cleveland council committee on public utilities.

■ ■

Wisconsin Gas Groups to Hold Joint Meeting in March

A JOINT convention and manufacturers' exhibit will be held by the Commercial and Technical Operating Divisions of the Gas Section, Wisconsin Utilities Association, March 15-17, at the Schroeder Hotel, Milwaukee.

Tentative plans call for addresses the first day by national authorities on commercial, engineering, and operating matters; for meetings, on the second day, conducted separately by the Commercial and Technical Divisions; and, on the third day, for technical round table discussions.

J. H. Fagan is chairman of the Exhibit Committee. Attendance is expected to approximate 350. A special tour of the Home Show at the Milwaukee Auditorium has been arranged.

■ ■

S. L. Tucker, American Meter Co. Controller, Passes

S. Lewis Tucker, Jr., controller of American Meter Co., died at the New Rochelle Hospital of a nose infection on Friday, December 18, after a brief illness of 5 days. He was born in Woodbury, N. J., and was 38 years old.

Mr. Tucker was graduated from the University of Pennsylvania and was a member of the Pennsylvania Institute of Certified Public Accountants.

Mr. Tucker joined the Treasurer's office of the company in March, 1930, and was appointed controller on January 1, 1935.

■ ■

Hill Hubbell Moves Branch

Hill Hubbel & Company, division of General Paint Corp., on January 1 moved its Chicago branch office to Cleveland, where quarters are now maintained at 1309 Mayfield Building. Deming Bronson will continue as manager of the company's pipe wrapping operations and will be established at the Cleveland address. A resident office is being continued in Chicago which will operate under the direction of Milton M. Bowen.

■ ■

Merriam Joins Glenwood

The Glenwood Range Co., Taunton, Mass., has added to its staff Charles W. Merriam, Jr., as promotion manager. Mr. Merriam was formerly manager of the Lynchburg Gas Co., Lynchburg, Virginia.

Standard Gas System Budgets $28,932,000 for 1937

With increases in gas and electric output the operating companies in the Standard Gas and Electric Co. system, Chicago, are faced with a need for extensions to lines and additional generating capacities. The company's preliminary construction budget for 1937 will total $33,470,000 for operating companies in the system. This amount includes expenditures of $6,784,000 to complete construction work on projects now in progress. Of the total proposed budget of $33,470,000, the actual amount estimated to be expended during 1937 is $28,932,000, this indicating that $4,538,000 of the proposed budget for 1937 will be appropriated for projects which will not be completed during the coming year but which will continue on into 1938.

■ ■

R. K.Tenney Resigns Ad Post With Baehr Organization

Rodger K. Tenney, advertising manager of the William A. Baehr Organization, Inc., Chicago, Illinois, for the past nine years, resigned January 1 and is now associated with the Bishop Publishing Co., Chicago. While with the William A. Baehr Organization, Mr. Tenney directed advertising for the gas and electric utilities operated by the company. The Bishop Publishing Co. creates and distributes a monthly display and sales floor poster service to utility companies throughout the country.

■ ■

Kansas Pipe Line Delivers Gas to Norton, Kans.

With the recent completion of its distribution system, Norton, Kans., is now being served with natural gas, according to press reports. The fuel is being supplied by the Kansas Pipe Line & Gas Co., Salina, Kans. White Construction Co. installed the distribution system.

A total of 300 applications for connections have been received, according to Lyle Quackenbush, local manager for the Kansas gas company. Of this number 130 individuals and firms are now using gas. Approximately 15 new meters are being installed daily.

■ ■

So. Calif. Co. Installs New Line to Redlands Area

Southern California Gas Co., of Los Angeles, Calif., has installed 10 miles of 6-inch gas line along Highway 99 to provide for the increased demand in the towns of Hemet, San Jacinto, Beaumont, Banning, and Palm Springs, according to R. T. McFadden, the company's district agent at Redlands. The new line is in addition to the 4-inch main which formerly served the territory.

■ ■

Southwest Gas Co. to Build Office in Ada, Oklahoma

Southwest Gas Company, Lockhart, Texas, will soon start construction of a one-story brick stucco office and shop building in Ada, Okla. The building, with a frontage of 60 feet and a depth of 70 feet, will be air conditioned by gas equipment. It is to be of modern Spanish design.

To the oil and gas industry Fluor offers three products—one service. The three products are: Aerator Type Cooling Towers, Air-Cooled Mufflers and Gas Cleaners.

In the capacity of oil country engineers and constructors, over a period of forty-four years, The Fluor Corporation has satisfied every technical demand. In the development and acceptance of its three products, Fluor has made tangible contributions to the industry's operating efficiencies and economies. Your request for further information will receive prompt attention.

THE FLUOR CORPORATION, LTD.

909 E. Fifty-Ninth St., Los Angeles, Calif.; 30 Church St., New York City; 909 McCormick Bldg., Chicago; 703 Fairfax Bldg., Kansas City; 719 McBirney Bldg., Tulsa; 1406 Esperson Bldg., Houston

BE SURE WITH FLUOR

FLUOR

OIL COUNTRY ENGINEERING & CONSTRUCTION
AERATOR TYPE COOLING TOWERS
AIR-COOLED MUFFLERS
GAS CLEANERS

Advanced and proven design, precision manufacture and complete engineering service, insuring successful application and installation, are the salient features of N.G.E. Gas Burning Equipment. Your request for descriptive Bulletins will receive prompt attention.

NATURAL GAS EQUIPMENT INC.

1123 Harrison St., San Francisco • Petroleum Securities Bldg., Los Angeles

LOOK TO THE PIONEERS FOR CONTINUED LEADERSHIP

South Carolina Cities Seek Natural Gas Service

Officials from six South Carolina cities and towns, meeting at Columbia, furthered plans for piping natural gas into the Palmetto state and named Mayor L. B. Owens of Columbia as chairman of a committee to begin negotiations with gas companies relative to the proposal. Several Georgia communities, it is understood, are also interested in getting natural gas.

Two companies mentioned as likely concerns to furnish gas to the South Carolina towns were Southern Natural Gas Corp., operating in Georgia, and Columbia Gas and Electric Corp., operating in West Virginia.

Towns interested in the proposal are: Batesburg, Leesville, Ward, Trenton, Monetta, Aiken, Warrenville, Clearwater, Bath, Langley, all in South Carolina, and several Georgia towns and cities.

■ ■

Pickard Named Acting Head of Laclede Gas Light Co.

Benjamin F. Pickard, vice-president and general manager of the Central States Power & Light Corp. of Oklahoma, and formerly a vice-president of Oklahoma Natural Gas Co., is in charge of The Laclede Gas Light Company, St. Louis, Mo., as acting general manager, according to press dispatches. He took over the post following the resignation of Edward P. Gosling as president of The Laclede Gas Light Co. and of Harley L. Clarke as chairman of Utilities Power & Light Corp., of which the Laclede company is an affiliate. Permanent appointments to fill the positions held by Gosling and Clarke are expected.

■ ■

Texas Cities El Paso Office Joins Mystery Chef

The El Paso office of Texas Cities Gas Co., Dallas, on December 14 joined the growing list of natural gas companies sponsoring radio broadcasts featuring Mystery Chef transcribed programs. El Paso's first program, Wednesday, brought 57 people into the gas company office for a copy of the gas cook book "Be an Artist at the Gas Range" on Wednesday alone.

■ ■

Gas Turned In New Line of Peoples Natural Gas Co.

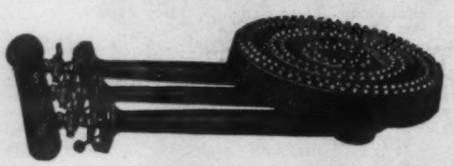
On December 20, natural gas was turned into the new 105-mile transmission line of the Peoples Natural Gas Co., Pittsburgh, Pa. The line which runs from Hebron Township in Potter County to the company's Pew compressor station near Limestone in Clarion County was completed last month.

■ ■

Bushnell Given Sales Post

B. O. Bushnell, effective December 1, joined the Daniel Orifice Fitting Co., Los Angeles, in the capacity of sales manager. Mr. Bushnell has been previously connected in sales capacities with Mid-West Piping & Supply Co., Inc., Neilan Co., and Union Oil.

JOHNSON NO. 40 ABC TRIPLE ATMOSPHERIC RING BURNERS



These powerful, durable efficient burners are ideal for any installation where heat is required. Provide intense heat at low operating cost. Made up of three independent ring burners which may be used singly, in pairs, or in triple. Embodies many exclusive Johnson features. Write for complete information.

JOHNSON GAS APPLIANCE Co.
Cedar Rapids IOWA

Western Representative:
C. B. BABCOCK CO.
135 Bluxome Street
San Francisco, Calif.

Eastern Representative:
J. H. McPHERSON
250 Stuart Street
Boston, Mass.

BASO

THERMO ELECTRIC SAFETY CONTROL FOR GAS BURNING APPLIANCES

BOILERS ★ FURNACES ★ CONV. BURNERS ★ SPACE HEATERS ★ UNIT HEATERS ★ AIR CONDITIONERS OVENS ★ RANGES ★ WATER HEATERS, ETC.

GAS VALVE SERIES 500

MILWAUKEE GAS SPECIALTY CO.
MILWAUKEE ★ WISCONSIN

ELECTRIC SWITCH SERIES 600

MODERN METHODS AND MATERIALS

A letter to GAS will bring you any of the selected reference bulletins listed below, without cost. Indicate by number which you desire.

NO. 160—HEATING CONTROLS

Loose-leaf folder covers a line of electrically operated limit switches for both pressure and temperature applications. Contains table of specifications.

NO. 161—VENT VALVES

Loose-leaf folder covers a line of air, vacuum and vent valves for venting radiators and mains on one-pipe steam and vacuum systems.

NO. 162—ROOFING MATERIALS

Illustrated bulletin describes roofing and re-roofing materials giving instructions for application with drawings showing how to deal with special parts such as flashing, coping, drains, skylights and angle supports.

NO. 163—WATER LEVEL REGULATOR

Leaflet gives performance charts and an installation diagram of a boiler water level control for rapidly fluctuating loads.

NO. 164—COMPRESSORS

Pamphlet covers a line of two-stage, air-cooled, V-type, single acting stationary compressors. These compressors can be direct connected or through V-belt drive with any type of power unit.

NO. 165—NON-CORRODING METALS

Twenty-page folder discusses the advantages of certain corrosion and heat resisting metals and alloys for such gas plant equipment as pumping and control equipment, meters, condensers, stills, generators, etc.

NO. 166—THERMOMETERS

Illustrated catalogue describes a line of thermostatic dial thermometers for ranges and other household appliances.

NO. 167—GAS ENGINES

Bulletin covers a line of 3-, 4-, 6-, and 8-cylinder gas engines that are convertible to Diesel operation. Chart gives ratings at various speeds.

NO. 168—ARC WELDER

Portable arc welder described in an illustrated folder giving complete specifications. Charts show volt-ampere curves obtainable.

NO. 169—SOLENOID VALVES

Extensive line of solenoid operated valves for automatic and remote control of air, gas, steam and liquids described in a catalogue illustrated with photographs and cut away drawings. Specifications for each type of valve are given in table form.

NO. 170—CONTROLS

Controls for regulating temperature, time, level, flow and pressure described in a folder giving dimensions of various sizes and types together with drawings showing construction.

NO. 171—GAS RANGES

Attractively compiled and illustrated 24-page bulletin covers a line of gas ranges for 1937. A series of 15 leaflets in color contained in a pocket describe each model.

GONE are the days of the town pump and the water wagon, thanks largely to cast iron pipe. More than 90 per cent of the water distribution and supply mains of this country are cast iron. But cast iron pipe contributes further to pure water supply as well as to the reduction of stream pollution through its use for filtration plants, for sanitary sewers and for sewage treatment and disposal plants. This Company, with technical experience accumulative for a generation—by research in product development—and through large stocks of pipe and fittings at strategic shipping points—offers a resourceful service to all engaged in water, sanitary and drainage problems.

U.S. cast iron PIPE

Cast iron and alloy cast iron pipe centrifugally or pit cast—for water works, gas, sewerage and drainage service as well as industrial uses involving corrosives.

U. S. PIPE & FOUNDRY CO.
BURLINGTON, NEW JERSEY
Foundries and Sales Offices throughout the U. S.

SUPER-DE LAVAUD CENTRIFUGAL CAST IRON PIPE

U. S. Pit Cast Pipe
U. S. Mechanical Joint Pipe
U. S. Flexible Joint Pipe
Alloy and Gray Iron Castings
U. S. Threaded Cast Iron Pipe
U. S. Ni-Resist Cast Iron Pipe
U. S. Cast Iron Culverts
U. S. Cast Iron Roof Plates

SPRAGUE METERS

REDUCE OPERATING COSTS

THE SPRAGUE METER COMPANY

LOS ANGELES + + SAN FRANCISCO

BRIDGEPORT, CONN.